

SPECIAL TOPICS / MISE AU POINT

STROKE TREATMENT IN A LOW RESOURCE SETTING: THE MOTEBANG HOSPITAL PROTOCOL

PRISE EN CHARGE DE L'ACCIDENT VASCULAIRE CEREBRAL (AVC) DANS UN SYSTEME DE SANTE AUX RESSOURCES LIMITEES : LE PROTOCOLE DE L'HOPITAL MOTEBANG, LESOTHO

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ABSTRACT**Background**

Stroke is increasingly recognized as a major cause of death and disability in low- and middle-income countries. Guidelines are available to improve stroke outcome, but are limited in their application to low-resource settings by unavailability of stroke specialists, neuroimaging, and treatment modalities.

Aims

To contextualise and adapt guidelines for emergency, inpatient, and post-discharge stroke care for application to the Motebang Hospital in Leribe District, Lesotho and similar low-resource district hospital settings.

Methods

Major international stroke guidelines for ischaemic and haemorrhagic stroke treatment and secondary prevention were systematically identified and reviewed, then iteratively discussed, contextualised, and adapted to the resources available at the Motebang Hospital.

Results

Because only a subset of stroke cases can be differentiated by clinical features as ischaemic versus haemorrhagic stroke, separate guidelines were proposed for Probable Ischaemic, Probable Haemorrhagic, and Uncertain Ischaemic/Haemorrhagic Stroke presentations. The individual subgroup guidelines aimed for optimal use of antithrombotic agents and blood pressure targets according to likelihood of ischaemic or haemorrhagic stroke. Other recommended steps such as early swallowing evaluation, removal of urinary catheters, regular skin assessment and care, physiotherapy, and post-discharge blood pressure control and lifestyle changes, were similar across all stroke categories.

Conclusion

The proposed Motebang Hospital Protocol offers substantial opportunities for improving stroke outcome and reducing recurrence that can be achieved without stroke specialists, acute brain imaging, or invasive stroke treatment modalities. These guidelines can serve as the basis for contextualised stroke care in similar hospital settings with limited resources.

RESUME

Contexte

L'accident vasculaire cérébral (AVC) est une cause majeure de mortalité et de handicap dans les pays à revenu faible ou modéré. De nombreuses recommandations de prise en charge de l'AVC sont disponibles, mais sont cependant d'application limitée dans des systèmes de soins aux ressources limitées par le manque d'accès aux spécialistes, à l'imagerie ou aux thérapeutiques coûteuses et invasives.

Objectif

Adapter les recommandations pour la prise en charge de l'AVC aux phases aiguë, hospitalière et post-hospitalière à l'hôpital de Motebang dans le district de Leribe, Lesotho, et aux hôpitaux possédant des ressources similaires.

Méthode

Les recommandations internationales sur le traitement et la prévention secondaire des AVC ischémique et hémorragique ont été examinées, discutées, contextualisées puis finalement adaptées aux ressources disponibles à l'hôpital de Motebang.

Résultats

Du fait du faible pouvoir discriminant des critères cliniques pour différencier l'AVC ischémique de l'AVC hémorragique, 3 sous-groupes de recommandations ont été établis : AVC *ischémique probable*, *hémorragique probable* et *étiologie incertaine*. Ces recommandations optimisaient l'usage d'agents antithrombotiques et les cibles tensionnelles à la probabilité d'une étiologie ischémique ou hémorragique. Les recommandations concernant l'évaluation précoce de la déglutition, le retrait de sonde urinaire, la prévention d'escarres, la rééducation, le contrôle tensionnel à distance et les règles hygiéno-diététiques ne différaient pas entre les sous-groupes.

Conclusion

Le protocole de l'hôpital de Motebang ouvre la porte à une amélioration importante du pronostic de l'AVC et du risque de récurrence qui peut être atteinte sans accès aux spécialistes, à la neuroimagerie, ou aux thérapeutiques invasives. Ces recommandations contextualisées pourront servir de support à d'autres centres soumis aux mêmes limitations de ressources.

BACKGROUND

Stroke, the largest source of long-term neurologic disability in high-income countries, is increasingly recognized as a major cause of death and disability in low- and middle-income countries as well. While stroke incidence has been decreasing over time in high-income countries, it is level or likely increasing in low- and middle-income countries to the point of exceeding the high-income country incidence(8). Stroke incidence, prevalence, and mortality appear to be particularly high in sub-Saharan Africa (32,33,39). Stroke prevention and treatment in sub-Saharan Africa is complicated by multiple factors associated with limitations of resources and community awareness, such as more limited control of hypertension, late presentation to the hospital, and unavailability of the full set of diagnostic and therapeutic modalities available in high-income countries (1,10,16,27,4,36). There also appears to be differences in epidemiology of stroke subtypes such as

a higher proportion of haemorrhagic relative to ischaemic strokes and disproportionate incidence in younger individuals (age <50) (22,35), potentially attributable to the high prevalence of untreated hypertension.

Lesotho, a small landlocked country in southern Africa, is challenged with the world's second highest HIV prevalence rate (38) and has only 0.068 doctors per 1000 people (13), representing approximately 160 doctors serving a population of two million. No systematic studies of stroke epidemiology have been conducted in Lesotho, but based on studies from neighbouring South Africa (18), stroke incidence and mortality are likely to be high. Motebang Hospital is the northern region's referral hospital and the district hospital for the Leribe district. Motebang represents a typical district hospital for the region and includes inpatient, surgical, and outpatient services. Limited available resources include X-ray, ultrasound, basic laboratory services, and auxiliary services such as physiotherapy. Stroke patients from throughout the district are referred for care at Motebang, and all referrals for tertiary services in the northern region are made from this hospital. Motebang is developing into a teaching hospital as the central training site for the country's only post graduate program, the Lesotho Boston Health Alliance (LeBoHA) Family Medicine Specialty Training Program (FMSTP), and is a core clinical rotation site in the new Lesotho medical internship program.

Evidence-based guidelines for improving outcome and secondary prevention have been developed by major international stroke organizations (2,12,15,19,21,26,37,40). These guidelines are generally not suitable for direct adoption (i.e. use as-is) into low-resource settings such as the Motebang Hospital and instead require either contextualisation (i.e. specification of additional local details for use) or adaptation (i.e. reformulation to meet local conditions) (7). We therefore convened meetings of a stroke specialist with leadership of the Motebang Hospital and LeBoHA with the goals of systematically reviewing the major international stroke guidelines and formulating an evidence-based protocol for use in the local context. The protocol described here contextualises and adapts the existing guidelines to develop protocols for emergency treatment over the first 24 hours, subsequent inpatient treatment, and secondary stroke prevention under conditions of having no stroke specialist, no access to head CT or MRI neuroimaging (and thus limited ability to differentiate between ischaemic versus haemorrhagic stroke types), and limited available treatment modalities. Although the protocol was designed for application at the Motebang Hospital, the approach can be further contextualised to similar district hospitals in low resource settings.

METHODS FOR GUIDELINE DEVELOPMENT

Evidence-based stroke guidelines from the American Heart Association/American Stroke Association, European Stroke Organization, the British National Institute for Health and Care Excellence, and the World Health Organization (2,11,12,15,19,21,26,37,40) were assembled by a stroke specialist (SMG) with experience in leadership of guideline development (12,19). These guidelines, listing specific recommendations for emergency treatment, early hospital care, post-stroke recovery, and secondary stroke prevention for ischaemic and haemorrhagic strokes considered separately, were then presented iteratively at a series of conferences with the Leribe District Medical Officer and LeBoHA FMSTP Senior Registrar (TN), LeBoHA FMSTP Senior Registrar (MC), LeBoHA FMSTP Director and Lesotho Ministry of Health Family Medicine Consultant (SM), LeBoHA FMSTP faculty member and Lesotho Ministry of Health Family Medicine Consultant (BB), and Volunteer Coordinator for LeBoHa and Boston University Family Medicine faculty member (AG). The conferences were held at the Motebang Hospital 2-6 September 2019.

The published international guidelines were systematically reviewed to determine which recommendations could be contextualized for use at the Motebang Hospital and which required adaptation. Because of the unavailability of diagnostic neuroimaging modalities for differentiating ischaemic from haemorrhagic stroke such as CT or MRI scan at the Motebang Hospital and most other hospitals in Lesotho, the adaptation process drew on the literature analysing clinical features whose presence or absence help differentiate between these two major types of stroke (4,20,23,25,30). Other literature and sources of information reviewed during the conferences were published studies analysing stroke care and decision-making in low-resource environments (3,14,24,27), regional standard treatment guidelines and essential medication lists from Lesotho and South Africa (17,28,29). The proposed guidelines reported here reflect the consensus of the conference attendees after iterative review and discussion.

PROPOSED GUIDELINES

Recommended acute stroke care varies substantially between ischaemic and haemorrhagic stroke (2, 12, 21, 26, 37). However, CT scanning, the primary modality for differentiating ischaemic from haemorrhagic stroke types, is unavailable at the Motebang Hospital and most other hospitals in Lesotho. The Motebang <http://ajns.paans.org>

Hospital guidelines for stroke treatment therefore focused on 1) clinical features for differentiating probable ischaemic and haemorrhagic stroke and 2) formulating additional sets of guidelines for individuals with uncertain ischaemic versus haemorrhagic stroke aetiology.

Analyses of clinical features for differentiating stroke type have demonstrated a high degree of overlap between ischaemic and haemorrhagic stroke across multiple populations and relatively few clinical features able to diagnose type with high specificity (4,20,23,25,30). Clinical features most consistently overrepresented in haemorrhagic stroke are headache at onset, vomiting, and impaired level of consciousness (Table 1). These features appear to carry relatively high specificity for haemorrhagic stroke but low sensitivity, as they are absent in the majority. The clinical features most consistently overrepresented in ischaemic stroke are history of transient ischaemic attacks (TIAs, operationally defined as prior events of neurologic deficit lasting less than 24 hours), atrial fibrillation, cardiomyopathy, valvular heart disease, and systemic atheromatous disease such as coronary artery or peripheral arterial disease. Table 1 lists additional clinical features associated with stroke subtype with less consistency across studies: gradual progression of symptoms over time (versus maximal severity at onset), and extensor plantar responses (also known as Babinski signs) favouring haemorrhagic strokes; pure face/arm/leg motor hemiparesis or pure face/arm/leg sensory loss appearing in a subset of ischaemic strokes.

The Motebang Hospital guidelines call on physicians initially evaluating patients presenting to the Emergency (Casualty) Unit to apply the above features to classify individuals with acute onset of neurologic deficits consistent with stroke into categories of Probable Ischaemic, Probable Haemorrhagic, and Uncertain Ischaemic/Haemorrhagic. Initial history and neurologic examination are focused on ascertaining the cardinal features of ischaemic or haemorrhagic stroke (Table 1). The Uncertain Ischaemic/Haemorrhagic category is applied when the features with highest specificity for stroke subtype are absent or are present in mixed ischaemic and haemorrhagic combinations.

Guidelines for emergency care for these three stroke categories are shown in Table 2. Initial treatment for all individuals is to assure cardiopulmonary stability and apply cardiopulmonary resuscitation steps (chest compressions, airway, and breathing or C-A-B) as needed (9). Other emergency steps shared across all stroke subtypes (2,12,21,26) are 1) treat hypoglycaemia (blood glucose <3.3 mmol/l) or hyperglycaemia (blood glucose >10.0 mmol/l) to aim for a conservative target glucose in the 7.8-10.0 mmol/l range; 2) identify and treat sources of hyperthermia (temperature $>38^{\circ}\text{C}$) and administer antipyretic medications to maintain normothermia; and 3) administer maintenance fluids with a focus on avoiding severe hyponatremia (serum sodium <130 mmol/L).

The key differences in emergency treatment for the three stroke categories are use of antithrombotic therapy and blood pressure targets. For Probable Ischaemic Stroke, recommendations are to initiate antiplatelet treatment acutely with aspirin 300mg (per oral, nasogastric, or rectal administration) and acutely lower blood pressures only if $\geq 220/120$ mm Hg or when a hypertensive emergency is present (2,21,26). Use of intravenous thrombolytics such as tissue plasminogen activator was not recommended because of the practical inability to obtain CT scan within 4.5 hours of symptom onset and the high risk of exacerbating intracerebral haemorrhage (ICH) if present. When treating blood pressures $\geq 220/120$ mm Hg, it is recommended to aim for modest $\sim 15\%$ reductions over the first 24 hours using agents available at the Motebang Hospital such as nifedipine or hydralazine. For Probable Haemorrhagic Stroke, the recommendations are to avoid early antithrombotic treatment and maintain blood pressure $<140/90$ mm Hg with the goal of reducing risk of early hematoma expansion (2,12,37). For individuals in the Uncertain Ischaemic/Haemorrhagic Stroke category expected to comprise the majority of acute stroke patients, the recommendations are to defer acute antiplatelet therapy during the first 24 hours following symptom onset and to lower blood pressures $\geq 180/105$ mm Hg.

Guidelines for subsequent Inpatient (Ward) care are similarly categorized according to the three stroke categories (Table 3). For Probable Ischaemic or Uncertain Ischaemic/Haemorrhagic Stroke, the recommended steps include continuation or initiation of antiplatelet therapy with aspirin 75mg per day, initiation of a statin medication, and lowering of the blood pressure to $<140/90$ mm Hg 2 to 4 days after stability of symptoms. For TIAs or minor probable ischaemic strokes (defined as a score of ≤ 3 on the National Institutes of Health Stroke Scale, <https://www.mdcalc.com/nih-stroke-scale-score-nihss>), it is reasonable to treat with dual antiplatelet therapy of aspirin 75mg plus clopidogrel 75mg daily for a total of 21 to 30 days to reduce the risk of early recurrent stroke, followed by conversion to antiplatelet monotherapy (26). A blood pressure target of $<140/90$ mm Hg is maintained and antiplatelet therapy is withheld for Probable Haemorrhagic Stroke. All other recommended steps are the same for the three stroke categories:

initiation of prophylaxis for deep venous thrombosis after 24 hours if the patient is not walking (with subcutaneous enoxaparin and pneumatic compression stockings if available), screening for dysphagia within 24 hours and prior to oral intake, placement of a nasogastric tube if unable to swallow and early initiation of feeding, removal of urinary catheters and substitution of incontinence padding as needed to reduce risk of urinary tract infections, regular skin assessments and turning of bedbound patients to prevent pressure sores, and initiation of physiotherapy with training of family members for post-discharge therapy as soon as feasible (2,40).

The remaining set of Motebang Hospital guidelines apply to secondary stroke prevention (Table 4). Recommended steps for secondary prevention following Probable Ischaemic or Uncertain Ischaemic/Haemorrhagic Stroke are long-term blood pressure control to a target of <140/90 mm Hg, aspirin 75mg daily, statin therapy, testing and treatment for diabetes mellitus, and lifestyle modifications as applicable including smoking cessation, increased physical activity, weight loss if obese, and dietary emphasis on higher consumption of vegetables, fruits, and whole grains and reduced salt, sweets, and red meat (15). If atrial fibrillation is detected during hospitalization and the patient is considered a candidate for regular monitoring of prothrombin time, it is reasonable to consider obtaining an outpatient head CT scan within 30 days of the stroke to exclude ICH and then instituting long-term anticoagulation with warfarin to a target International Normalized Ratio of 2.0-3.0. Secondary prevention steps for Probable Haemorrhagic Stroke differ in targeting blood pressure treatment to a systolic pressure <130 mm Hg (12) and avoidance of antiplatelet, anticoagulation, or statin therapy unless for another clear indication. Recommendations for diabetes control and lifestyle modifications are the same post-ICH as post-ischaemic or uncertain strokes.

DISCUSSION

The protocols proposed here for emergency, inpatient, and post-discharge stroke treatment represent application of the guidelines from major international stroke organizations to the practice environment at the Motebang Hospital and similar district hospitals in Lesotho. They are designed to improve stroke outcome and reduce risk of recurrence without requiring diagnostic testing or treatment modalities unavailable in this setting. They are also designed to be applied by primary care physicians and other health care practitioners without specialized training in neurology. The proposed diagnostic categories of Probable Ischaemic, Probable Haemorrhagic, and Uncertain Ischaemic/Haemorrhagic Stroke (Table 1) are defined by features of the medical history and clinical presentation that are straightforward to elicit from rapid patient and family interview and examination.

Designing guidelines for the common scenario of Uncertain Ischaemic/Haemorrhagic Stroke is challenging, as goals for thrombosis and to a lesser extent blood pressure control are at cross purposes for ischaemic and haemorrhagic strokes. The Motebang Hospital guidelines seek to maximize good outcome in this situation by 1) deferring antithrombotic treatments such as aspirin until 24 hours post symptom onset, and 2) allowing acute blood pressures to range up to 180/105 mm Hg (Table 2). Initiation of aspirin within 48 hours of ischaemic stroke onset reduces post-stroke death or dependency with a number needed to treat of 79 (31). A decision analysis model suggested that acute aspirin treatment might also be effective for uncertain ischaemic/haemorrhagic strokes (3). This model was based on a (possibly optimistic) assumption of reduced post-ICH in-hospital mortality with aspirin use (risk ratio 0.886) and was sensitive to even modest increases in post-ICH mortality (risk ratio >1.057 favoured avoiding aspirin). The Motebang protocol therefore recommended initiating aspirin only after the first 24 hours, during which hematoma expansion is common (6). The <180/105 mm Hg blood pressure threshold was selected as acceptable both as an upper limit for acute ICH (12) and for avoiding hypoperfusion following acute ischaemic stroke (2,26).

Despite the unavailability of many of the neuroimaging and treatment modalities incorporated by international stroke guidelines such as acute CT scanning, thrombolysis, thrombectomy, and carotid revascularization (2,12,15,21,26,37), the Motebang Hospital guidelines nonetheless offer the opportunity for substantial improvements in stroke outcome and recurrence. Steps such as dysphagia screening, use of pneumatic compression stockings, skin assessment, removal of urinary catheters, outpatient blood pressure control, and aspirin and statin therapy following ischaemic stroke are endorsed at the highest strength of recommendation by the American Heart Association/American Stroke Association (12,26,40), indicating benefit that greatly exceeds risk. An analysis of the Muhimbili National Hospital, a large referral hospital in Dar es Salaam, Tanzania, found that some recommended post-ischaemic stroke treatments with low numbers-needed-to-treat to improve outcome such as aspirin and statin use were applied to a majority of stroke patients, whereas others such as deep vein thrombosis prophylaxis were uncommonly used (27). Anticoagulation for secondary prevention of atrial fibrillation-related stroke poses substantial challenges

related to the need to exclude haemorrhagic stroke and to monitor warfarin dosing (5), but is another highly effective therapeutic option. Non-vitamin K antagonist oral anticoagulants such as apixaban are not currently available in Lesotho, but could represent a future option that would avoid the need for frequent monitoring (5).

CONCLUSION

The Motebang Hospital protocol for stroke care represents an evidence-based approach to reducing mortality, disability, and recurrence of a devastating and increasingly common disease. These practical guidelines designed for the Motebang Hospital can also serve as the basis for more general application to other district hospitals in Lesotho and other resource-limited settings.

Table 1. Clinical features favouring ischaemic versus haemorrhagic stroke aetiology

Favours Ischaemic Stroke
History of transient ischaemic attacks
Atrial fibrillation
Cardiomyopathy
Valvular heart disease
Systemic atheromatous disease (e.g. coronary artery, peripheral arterial disease)
Specific stroke syndromes: Pure face/arm/leg motor hemiparesis, pure face/arm/leg sensory loss
Favours Haemorrhagic Stroke
Headache at onset
Vomiting
Impaired level of consciousness
Gradual progression of symptoms over time
Extensor plantar responses (Babinski sign)

Table 2 Emergency (Casualty) Care for Stroke Patients

Probable Ischaemic
1. Assure chest compressions, airway, and breathing as needed (C-A-B)
2. Aspirin 300mg STAT
3. Treat blood pressure only if $\geq 220/120$ mm Hg or if hypertensive emergency such as hypertensive cardiac or renal failure; if treating aim for ~15% reduction in first 24 hours
4. Treat hypoglycaemia (glucose < 3.3 mmol/l) or hyperglycaemia (glucose > 10.0 mmol/l) to target 7.8-10.0 mmol/l
5. Identify and treat sources of fever (temperature $> 38^{\circ}\text{C}$), including antipyretic medications as needed
6. Maintenance fluids (avoid serum sodium < 130 mmol/L)
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Probable Haemorrhagic

1. Assure chest compressions, airway, and breathing as needed (C-A-B)
2. No aspirin
3. Treat blood pressure if >140/90 mm Hg to maintain ≤140/90
4. Treat hypoglycaemia (glucose <3.3 mmol/l) or hyperglycaemia (glucose >10.0 mmol/l) to target 7.8-10.0 mmol/l
5. Identify and treat sources of fever (temperature >38°C), including antipyretic medications as needed
6. Maintenance fluids (avoid serum sodium <130 mmol/L)

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Uncertain Ischaemic/Haemorrhagic

1. Assure chest compressions, airway, and breathing as needed (C-A-B)
 2. No aspirin for first 24 hours after onset
 3. Treat blood pressure only if ≥180/105 mm Hg, if treating aim for ~15% reduction in first 24 hours
 4. Treat hypoglycaemia (glucose <3.3 mmol/l) or hyperglycaemia (glucose >10.0 mmol/l) to target 7.8-10.0 mmol/l
 5. Identify and treat sources of fever (temperature >38°C), including antipyretic medications as needed
 6. Maintenance fluids (avoid serum sodium <130 mmol/L)
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Table 3. Inpatient Floor (Ward) Protocol for Stroke Patients

Probable Ischaemic

1. Continue aspirin 75mg daily.
 2. Consider aspirin 75mg daily and clopidogrel 75mg daily for 21-30 days for transient ischaemic attack or minor stroke (National Institutes of Health Stroke Scale ≤3)
 3. Target blood pressure control to <140/90mm Hg beginning 2 to 4 days after stroke onset
 4. Initiate statin therapy
 5. Initiate deep vein thrombosis prophylaxis if not walking within first 24 hours (subcutaneous enoxaparin, pneumatic compression stockings if available)
 6. Swallowing evaluation within 24 hours and prior to oral intake
 7. Placement of a nasogastric tube and initiation of feeding if unable to swallow safely after 24 hours
 8. Remove urinary catheter, substitute incontinence padding if needed
 9. Regular skin assessments and turning of bedbound patients if patient unable to turn in bed
 10. Encourage sitting, standing or walking when patient is able
 11. Initiate physiotherapy, training of family members for post-discharge therapy
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Probable Haemorrhagic

1. Continue blood pressure control to <140/90
2. Initiate deep vein thrombosis prophylaxis if not walking within first 24 hours (subcutaneous enoxaparin, pneumatic compression stockings if available)
3. Swallowing evaluation within 24hours and prior to oral intake
4. Placement of a nasogastric tube and initiation of feeding if unable to swallow safely after 24 hours
5. Remove urinary catheter, substitute incontinence padding if needed
6. Regular skin assessments and turning of bedbound patients if patient unable to turn in bed
7. Encourage sitting, standing or walking when patient is able
8. Initiate physiotherapy, training of family members for post-discharge therapy

-
Uncertain Ischaemic/Haemorrhagic

1. Continue aspirin 75mg daily
 2. Target blood pressure control to <140/90mm Hg beginning 2 to 4 days after stroke onset
 3. Initiate statin therapy
 4. Initiate deep vein thrombosis prophylaxis if not walking within first 24 hours (subcutaneous enoxaparin, pneumatic compression stockings if available)
 5. Swallowing evaluation within 24hours and prior to oral intake
 6. Placement of a nasogastric tube and initiation of feeding if unable to swallow safely after 24 hours
 7. Remove urinary catheter, substitute incontinence padding if needed
 8. Regular skin assessments and turning of bedbound patients if patient unable to turn in bed
 9. Encourage sitting, standing or walking when patient is able
 10. Initiate physiotherapy, training of family members for post-discharge therapy
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Table 4. Secondary stroke prevention

Probable Ischaemic Stroke

1. Blood pressure control (goal <140/90mm Hg)
 2. Aspirin 75mg daily
 3. Statin therapy
 4. Test for and treat diabetes mellitus
 5. If atrial fibrillation detected and patient is candidate for regular monitoring of prothrombin time, consider CT scan within 30 days of stroke onset and initiation of warfarin anticoagulation (target International Normalized Ratio 2.0-3.0)
 6. Lifestyle modifications as applicable
 - a. Smoking cessation
-

- b. Increased physical activity
- c. Weight loss
- d. Diet (high vegetables, fruits, whole grains; reduced salt, sweets, red meat)

Probable Haemorrhagic Stroke

1. Blood pressure control (goal <130/85mm Hg)
2. Avoid antiplatelet or anticoagulant agents unless other clear indication
3. Test for and treat diabetes mellitus
4. Lifestyle modifications as applicable
 - a. Smoking cessation
 - b. Increased physical activity
 - c. Weight loss
 - d. Diet (high vegetables, fruits, whole grains; reduced salt, sweets, red meat)

Uncertain Ischaemic/Haemorrhagic Stroke

1. Blood pressure control (goal <140/90mm Hg)
2. Aspirin 75mg daily
3. Statin therapy
4. Test for and treat diabetes mellitus
5. If atrial fibrillation detected and patient is candidate for regular monitoring of prothrombin time, consider CT scan within 30 days of stroke onset and initiation of warfarin anticoagulation (target International Normalized Ratio 2.0-3.0)
6. Lifestyle modifications as applicable
 - a. Smoking cessation
 - b. Increased physical activity
 - c. Weight loss
 - d. Diet (high vegetables, fruits, whole grains; reduced salt, sweets, red meat)

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