

Introduction of China Guideline for Cerebrovascular Disease Prevention and Treatment

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I. Background and principle of preparation

1. Cerebrovascular Disease Group of Chinese Society of Neurology of Chinese Medical Association was founded (July 7, 2002).
2. Disease Control Division of Ministry of Health and Chinese Society of Neurology of Chinese Medical Association entrusted the Cerebrovascular Disease Group to organize multidisciplinary experts to prepare *China Guideline for Cerebrovascular Disease Prevention and Treatment* (from the fourth quarter of 2002).
3. Principle of preparation: it was formed based on the results of evidence-based medicine, by reference to the prevention and treatment guidelines of cerebrovascular diseases and relevant diseases published recently at home and abroad, and by maintaining the serious, scientific and pragmatic attitude, abiding by the principles of scientificity, practicability, feasibility and highest possible international compatibility extensively soliciting the opinions of experts from relevant disciplines according to the actual situation of China through several discussions and repeated revisions.

II. Content

Chapter I Primary prevention of cerebrovascular diseases

Section I Epidemic status and development trend of cerebrovascular diseases in China

At present, the cerebrovascular disease has become the major disease endangering the physical health and life of Chinese middle aged and elderly people. The death of urban residents due to the cerebrovascular disease has ranked the first and second, while the death of people in rural areas ranked the third in the early 1990s, and ranked the second in the late 1990s. About 2 million people have new-onset cerebral stroke every year throughout China, about 1.5 million people died due to the cerebrovascular disease every year, and 6-7 million patients (including the cured ones) survive. Currently, nearly RMB 20 billion is expended for the disease each year nationwide, which causes severe economical burden to the country and many families.

Section II Risk factors, intervention and management of cerebrovascular diseases

I. Hypertension

The hypertension is the most important risk factor of cerebral hemorrhage and cerebral infarction. A domestic study shows that the relative onset risk of cerebral stroke will increase by 49% for every 10mmHg increases in systolic blood pressure (SBP), while the relative onset risk of cerebral stroke will increase by 46% for every 5mmHg increases in when the diastolic blood pressure (DBP) if other risk factors have been controlled. A random controlled clinical trial on elderly systolic hypertension in China showed the death rate of the antihypertensive therapy group due to cerebral stroke decreased by 58% as compared with that of the placebo control group after follow-up for 4 years.

Suggestions: (1) further strengthen the publicity and education, raise the cerebral stroke prevention awareness of residents to allow them to actively pay attention to their blood pressure; it's suggested that the people ≥ 35 years old should have their blood pressure measured once per year, and the patients with hypertension should have their blood pressure measured frequently (at least every 2-3 months) in order to adjust the dose. (2) The hospitals of all levels shall establish the blood pressure measurement system for the adults at the first visit as soon as possible. (3) All regions shall positively create the conditions to establish model communities on a certain scale to periodically screen the hypertension patients from the population and give proper treatment and follow-up. (4) The patients with early or mild hypertension shall be treated by changing the lifestyle, and the anti-hypertensive drugs shall be administrated in case of poor response after 3 months.

II. Heart disease

The risk of cerebral stroke in patients with heart disease is more than twice of that of those without heart disease. The risk of cerebral stroke in patients with nonvalvular atrial fibrillation is 3-5% each year, approximately 50% of thromboembolic stroke.

Suggestions: (1) The adults (≥ 40 years) shall undergo periodic physical examination to detect the heart disease early. (2) The patients diagnosed with the heart disease shall seek medical advice from the specialists actively. (3) The patients with nonvalvular atrial fibrillation may receive anticoagulant therapy with warfarin if the conditions permit, but the international normalized ratio (INR) must be monitored and shall be controlled between 2.0 and 3.0; INR should be 1.6-2.5 for patients > 75 years; or they may take aspirin 50-300mg/d, or other anti-platelet aggregation drugs. (4) The high-risk patients with coronary heart disease shall also take low-dose aspirin 50-150mg/d, or other anti-platelet aggregation drugs.

III. Diabetes mellitus

Diabetes mellitus (DM) is an important risk factor of cerebrovascular diseases. The risk of stroke in patients with type II DM is doubled.

Suggestions: (1) The blood glucose shall be tested periodically, and glycosylated hemoglobin (HbA1c) and glycosylated plasma albumin shall be measured if necessary for people with the risk factor of cardiac-cerebrovascular diseases. The diagnosis criterion of DM is the same as that in China Guideline for Diabetes Mellitus Prevention and Treatment. (2) The DM patients shall control the diet and strengthen physical exercise first, and if the blood glucose control is unsatisfactory after 2-3 months, they shall be treated with oral hypoglycemic drugs or insulin. (3) The DM patients shall even more actively treat the hypertension, control the body weight and decrease the cholesterol level.

IV. Dyslipidemia

Many studies have confirmed the close relationship of the serum total cholesterol (TC), increased low density lipoprotein (LDL) and decreased high-density lipoprotein (HDL) with the cardiovascular disease.

Suggestions: (1) The unhealthy lifestyle shall be changed, and the blood lipid shall be tested periodically for the patients with dyslipidemia, particularly in combination with other risk factors such as hypertension, DM, and smoking. Those patients without response to the change of lifestyle shall be treated with the drugs. (2) The patients with the history of TIA (transient ischemic attack), ischemic stroke or coronary heart disease, and TC > 5 mmol/L may be treated with statins. The patients with increased TG shall be treated with fibric acid drugs.

V. Smoking

Frequent smoking is a recognized risk factor of ischemic cerebral stroke. It causes physiological and pathological effects on the body from multiple aspects, and mainly influences the vessel and blood system of the whole body, for example, accelerating arteriosclerosis, increasing fibrinogen, promoting platelet aggregation and decreasing high-density lipoprotein. Long-term passive smoking may also increase the risk of cerebral stroke.

Suggestions: (1) Advise the smokers to abandon smoking (mobilize the relatives of the smokers to participate in persuasion and provide an effective smoking cessation method). (2) Mobilize the whole society to participate, and take comprehensive smoking control measures among the community populations to give interventions to the smokers. (3) Promote the governments of all regions to formulate the smoking regulations as soon as possible, for example, establishing a non-smoking area in public places such as the office, meeting room, airplane and train, and only permitting smoking in the designated places to reduce the harm of passive smoking.

VI. Alcohol consumption

The population research evidence has shown that the alcohol intake has direct dosage association with the hemorrhagic stroke. However, there's still a dispute on the association with the ischemic stroke at present.

Suggestions: (1) Do not advocate the non-drinkers to drink a small amount of alcohol to prevent the cardia-cerebrovascular diseases; the pregnant women shall avoid drinking. (2) The drinkers shall drink moderately, and the daily alcohol consumption shall not exceed 20-30g for males and 15-20g for females.

VII. Carotid artery stenosis

Some foreign studies find that 7-10% of males and 5-7% of females among the populations > 65 years have carotid artery stenosis > 50%.

Suggestions: (1) The operative treatment or endovascular intervention is not recommended generally for the asymptomatic patients with carotid artery stenosis, and the treatment with antiplatelet drugs such as aspirin or statins is preferred. (2) For the patients with severe carotid artery stenosis (> 70%), carotid endarterectomy or endovascular intervention may be considered if the conditions permit (but it shall be determined after comprehensive analysis and discussion according to the wills of patients and family members, presence of complications and physical conditions of patients).

VIII. Obesity

A domestic prospective study among 10 populations shows that the relative risk of ischemic stroke in the obese people is 2.2. In recent years, several large studies show that the abdominal obesity has closer association with the stroke than increased body mass index (BMI) or homogeneous obesity.

Suggestions: (1) Persuade the overweight and obese people to lose weight by adopting a healthy lifestyle and increasing the physical activities to reduce the risk of stroke. (2) Advocate a healthy lifestyle and good dietary habit. For the adults, BMI (kg/m²) shall be controlled less than 28, the waistline/hipline ratio shall be < 1, and the weight fluctuation shall be less than 10%.

IX. Other risk factors

Hyperhomocysteinemia; metabolic syndrome; lack of physical activities; unreasonable diet nutrition; oral

contraceptives; procoagulant risk factor.

Section III Content and method of health education

I. Content of health education

Three major aspects: (1) allow people to understand the serious harms of cerebrovascular disease to attract their attention and prevent the disease actively; (2) tell people the major risk factors and inducing factors of cerebrovascular disease and how to prevent it; (3) how to cope with cerebral stroke after onset.

II. Method of health education

Hospital health education; community health education; health education through mass media.

Chapter II Secondary prevention of cerebral stroke

Section I Risk factors of recurrence of cerebral stroke

The relevant risk factors of recurrence of stroke include unmanageable risk factors and manageable risk factors. The manageable risk factors further include physiological risk factors, such as hypertension, DM, hyperlipidaemia, heart disease and hyperhomocysteinemia, and behavioral risk factors, such as smoking, excessive drinking, obesity and depression (see Chapter I).

Section II Secondary prevention measures of recurrence of cerebral stroke

I. Correct evaluation of pathogenesis of first stroke

Suggestions: Perform necessary imaging or other laboratory examinations on the patients with cerebral stroke to determine the stroke type and relevant risk factors of the patients as far as possible in order to take the reasonable therapeutic measures according to the pathogenesis.

II. Post-stroke blood pressure management

The blood pressure > 160/100mmHg of the patients may obviously increase the recurrence risk of stroke.

Suggestions: (1) Change the unhealthy lifestyle. (2) Actively control the hypertension, and reduce the blood pressure to < 140/90mmHg if the patients are tolerable. For the drug selection, refer to "Chapter I" or China Guideline for Hypertension Prevention and Treatment. (3) The antihypertensive therapy shall begin when the patients' conditions are stable after the acute phase of stroke (generally 4 weeks after stroke).

III. Antiplatelet aggregation

Early administration of low-dose aspirin (50mg/d) after initial attack of ischemic stroke can significantly reduce the risk of recurrence of stroke.

Suggestions: (1) aspirin alone, 50-150mg/d, taken in 2 doses; (2) compound preparation (tablet or capsule) of low dose aspirin (25mg) and sustained release dipyridamole (200mg), bid; (3) clopidogrel, if intolerable to aspirin, 75mg/d.

IV. Anticoagulation therapy

The risk of intracranial hemorrhage will be increased if the anticoagulant is administrated. The anticoagulant should be administrated to the patients diagnosed with cardiogenic embolism induced by atrial fibrillation (particularly nonvalvular atrial fibrillation).

Suggestions: (1) It's clear that the anticoagulant therapy with warfarin 2-4mg/d may be used for patients with cardiogenic embolism induced by nonvalvular atrial fibrillation, but INR shall be controlled between 2.0 and 3.0. If INR cannot be monitored, aspirin, instead of warfarin, should be used for treatment. (2) Anticoagulation is inappropriate at the acute stage of stroke, and the anticoagulant therapy may start 2 weeks after the attack of stroke generally.

- V. Intervention for other heart diseases
- VI. Intervention for carotid artery stenosis
- VII. Intervention for hyperhomocysteinemia
- VIII. Intervention for transient ischemic attack (TIA)
- IX. Management of post-stroke blood lipid and blood glucose
- X. Health education and intervention for behavioral risk factors

Chapter III Stroke unit

I. Concept

A stroke unit refers to an organization system which improves the medical management mode of stroke inpatients, and provides medication, limb rehabilitation, language training, psychological rehabilitation and health education for the stroke patients to improve the efficacy.

II. Classification

- (I) Acute stroke unit
- (II) Rehabilitation stroke unit
- (III) Combined stroke unit
- (IV) Mobile stroke unit

III. Significance of establishing the stroke unit

- (I) Can obtain a better clinical effect
- (II) Improve the satisfaction of the patients and their family members
- (III) Be beneficial to continuing education

IV. Establishment and implementation of stroke unit

- (I) Healthcare condition and facility of hospital
- (II) Selection of stroke unit mode
- (III) Reconstruction of ward structure
- (IV) Set up a medical team for stroke
- (V) Develop good clinical practice (GCP) and standard
- (VI) Standard work schedule

Suggestions: (1) The hospital treating the cerebrovascular diseases shall establish the stroke unit, and the stroke patients shall be treated in the stroke unit as far as possible. (2) The stroke unit is established on a basis of the ward space conditions, multidisciplinary medical team and GCP. (3) The hospitals of different levels shall select an appropriate stroke unit according to their own conditions.

Chapter IV Pre-hospital management of cerebral stroke

- I. Identification of cerebral stroke
- II. Transport of cerebral stroke patients

III. Treatment and first aid in the field and on ambulance

Information to be collected; first aid measures and relevant treatment

Chapter V Emergency diagnosis and treatment

I. Diagnosis

- (I) History collection and physical examination
- (II) Diagnostic analysis procedure: stroke or other diseases; which kind of stroke; presence of thrombolysis indication for acute ischemic stroke patients.

II. Treatment

- (I) Basic life support: airway and breathing; cardiac function; blood pressure control
- (II) Conditions needing emergency treatment
- III. Emergency treatment procedure

Chapter VI Diagnosis and treatment of common cerebrovascular diseases

Section I Transient ischemic attack (TIA)

I. Diagnosis

- (I) Clinical characteristics
- (II) Auxiliary examination: head CT and MRI; ultrasonography; cerebral angiography; DSA, CTA, MRA; other examinations

II. Treatment

- (I) Risk factor control (see Section III in Chapter I)
- (II) Medication

1. Anti-platelet aggregation drug

Suggestions: (1) Aspirin is preferred for most TIA patients, and the recommended dose is 50-325mg/d. (2) Compound preparation of ASA 25mg and sustained release DPA 200mg (bid) or clopidogrel 75mg/d is recommended for patients intolerable to aspirin or “without response to aspirin”. (3) The attention shall be paid to the blood routine during the treatment if ticlopidine is administrated. (4) The anti-platelet aggregation drug for intravenous drip may be chosen for frequent TIA.

2. Anticoagulants

Suggestions: (1) Anticoagulation therapy is not taken as the routine therapy. (2) The anticoagulation therapy is recommended for TIA patients with atrial fibrillation and coronary heart disease (excluding infective endocarditis). (3) The anticoagulation therapy may be considered if the symptoms of TIA patients recur frequently though having received the antiplatelet therapy.

3. Defibrase drug

Batroxobin or defibrase treatment may be considered for the TIA patients with blood composition change sometimes, for example, obvious increase of fibrinogen content, or frequently recurrent patients.

(III) Surgical treatment of TIA

See relevant sections in Chapters VII and VIII of this Guideline for details.

Section II Cerebral infarction

I. Diagnosis

(I) General diagnosis

1. Clinical characteristics
2. Auxiliary examination

(1) Blood test

(2) Imaging: CT, MR, TCD, angiography and others.

(II) Clinical typing (OCSP typing)

OCSP clinical typing criteria: 1. total anterior circulation infarct (TACI); 2. partial anterior circulation infarct (PACI); 3. posterior circulation infarct (POCI); 4. lacunar cerebral infarct (LACI)

II. Treatment

(I) Medical comprehensive supportive treatment: pay special attention to the blood pressure control (see Chapter IX)

(II) Anti-encephaledema and intracranial hypertension reduction (see Chapter IX)

(III) Improve cerebral blood circulation

1. Thrombolysis

Suggestions: (1) The intravenous thrombolysis shall be actively performed on the strictly chosen acute ischemic stroke patients within 3h after attack. rt-PA is preferred, and urokinase may be administrated as an alternative if rt-PA is unavailable. (2) The intravenous urokinase thrombolysis therapy may be performed on the acute ischemic stroke patients within 3-6h after attack, but the patients shall be chosen more strictly. (3) The intra-arterial thrombolysis study may be considered for the acute ischemic stroke patients within 3-6h after attack in the organizations with eligible experience and conditions. (4) The time window and indications for thrombolysis for vertebrobasilar thrombolysis may be liberalized appropriately. (5) Thrombolysis after exceeding the time window will not improve the treatment effect mostly, but will increase the complications such as reperfusion injury and hemorrhage, so that the thrombolysis is inappropriate. Thrombolysis is forbidden for patients in the recovery phase.

2. Defibrase therapy

(1) Batroxobin; (2) Defibrase; (3) other defibrase preparations: such as lumbrokinase and acutase.

Suggestions: (1) The defibrase therapy may be chosen in the early stage of cerebral infarction (especially within 12h), and it shall be performed on the patients with hyperfibrinogenemia more actively. (2) The indications and contraindications shall be mastered strictly.

3. Anticoagulation therapy

Suggestions: (1) Routine immediate administration of anticoagulant is not recommended for acute cerebral infarction patients generally. (2) The administration of an anticoagulant within 24h is not recommended for the patients undergoing thrombolysis. (3) In the absence of contraindications (such as bleeding tendency, serious liver and kidney diseases, and blood pressure > 180/100mmHg), the selective administration of anticoagulant may be considered: ① patients with cardiogenic infarct (such as artificial valve, atrial fibrillation, myocardial infarction with mural thrombosis, and left atrial thrombosis) have high possibility of stroke recurrence. ② Ischemic stroke patients with thrombophilia such as protein C deficiency,

protein S deficiency and active protein C resistance; patients with symptomatic extracranial dissecting aneurysm; patients with intracranial and extracranial arteriostenosis. ③ Bedrid patients with cerebral infarction may be administrated with low dose heparin or an appropriate dose of LMW to prevent deep venous thrombosis and pulmonary embolism.

4. Antiplatelet aggregation preparation

Suggestions: (1) Most patients without contraindications or thrombolysis shall be administrated with aspirin as soon as possible after stroke (best within 48h). (2) The thrombolysis patients shall be administrated with aspirin or the compound preparation of aspirin and sustained release dipyridamole within 24h after thrombolysis (see Chapter II for details). (3) The recommended dose of aspirin is 150-300mg/d, bid, which is changed to the preventive dose 4 weeks later.

5. Volume expansion

6. Treatment with traditional Chinese medicine: for example, Salvia Miltiorrhiza, Ligustrazine, Notoginseng, Puerarin and Folium Ginkgo Preparation.

(IV) Neuroprotective agent

The common neuroprotective agents include cytidine diphosphate, duxil, piracetam and calcium channel blocker at present. The convincing large-sample clinical observation data is absent, and the definite efficacy remains to be further investigated.

Mild hypothermia and high pressure oxygen are possibly promising therapies, and the relevant studies are in progress.

(V) Surgical treatment: see Chapter VII.

(VI) Intravascular interventional treatment: see Chapter VIII.

(VII) Rehabilitation: See Chapter XI.

Section III Cerebral hemorrhage

I. Diagnosis

(I) General diagnosis

1. Clinical characteristics

2. Auxiliary examination

(1) Blood test

(2) Imaging: ①head CT scanning; ② head MRI; ③ cerebral angiography (DSA).

(3) Lumbar puncture

(II) Essentials of clinical diagnosis for cerebral hemorrhage in each site

Putamina hemorrhage; thalamic hemorrhage; brain stem hemorrhage; cerebellar hemorrhage; lobar hemorrhage; intraventricular hemorrhage

(III) Cause of cerebral hemorrhage

Hypertensive cerebral hemorrhage; hemorrhage due to cerebrovascular malformation; cerebral amyloid

angiopathy; cerebral hemorrhage due to thrombolysis; cerebral hemorrhage due to anticoagulation; tumor stroke

II. Treatment

(I) Medical treatment for acute cerebral hemorrhage

General treatment: blood pressure control; intracranial pressure reduction; hemostatic drugs; mild hypothermia therapy; rehabilitation therapy

(II) Surgical treatment

Suggestions: (1) cerebral hemorrhage shall be considered for middle-aged and elderly patients with a history of hypertension, who suddenly have focal neurologic deficit with headache, vomiting and increased blood pressure. Head CT scan is preferred, definitive diagnosis, site and amount of cerebral hemorrhage, breaking into ventricle, mass effect and brain tissue displacement. (2) Determine the therapy according to the site and amount of hemorrhage: ① Basal ganglion hemorrhage: conservative medical management for small hemorrhage; minimally invasive evacuation of hematoma or small bone flap craniotomy evacuation of hematoma at the right time according to the patients' conditions, hemorrhage site and healthcare conditions for moderate hemorrhage (putamina hemorrhage $\geq 30\text{ml}$, thalamic hemorrhage $\geq 10\text{ml}$); bone flap decompression evacuation of hematoma to save the life in the surgery department in most cases for patients with massive hemorrhage or brain herniation. ② Cerebellar hemorrhage: at high risk of cerebral hernia, bleeding volume $\geq 10\text{ml}$, or diameter $\geq 3\text{cm}$, or with obvious hydrocephalus; perform surgical treatment as soon as possible if the conditions permit. ③ Lobar hemorrhage: the elderly patients are often manifested as hemorrhage due to amyloid angiopathy, and the conservative medical treatment is appropriate except that the large hematoma endangering the life or the hemorrhage caused by vascular malformation shall receive surgical treatment. ④ Cerebral ventricular hemorrhage: the conservative medical treatment may be performed for the mild partial cerebral ventricular hemorrhage, while ventricular puncture drainage and lumbar puncture drainage shall be performed for severe whole ventricular hemorrhage (ventricular hemorrhage cast). (3) The medical treatment is a basic therapy for the cerebral hemorrhage, dehydration, intracranial pressure reduction, blood pressure control and complication prevention and treatment are key links of treatment, and the patients shall be managed carefully (see Chapter IX for details).

Section IV Subarachnoid hemorrhage

I. Diagnosis

(I) Clinical characteristics

(II) Auxiliary examination: CT; CSF; cerebral angiography (DSA, CTA and MRA); others: TCD and local cerebral blood flow measurement

II. Treatment

General management and symptomatic treatment; rebleeding prevention and treatment; prevention and treatment of cerebral arterial spasm and cerebral ischemia; hydrocephalus prevention and treatment

Suggestions: (1) If the conditions permit, SAH patients shall be evaluated by the neurosurgeons initially, and admitted for treatment; if the patients see medical advice in the neurology department, ask the neurosurgery department for consultation, and find the causes for treatment as early as possible. (2) Brain CT is preferred for the diagnostic examination of SAH, and the dynamic observation helps understanding the bleeding absorption, rebleeding and secondary injury. (3) For patients with typical clinical manifestations but without bleeding sign on CT, the lumbar puncture CSF examination may be performed with caution to make a

definite diagnosis. (4) Try to perform cerebral angiography if the conditions permit; perform DSA as early as possible if aneurysm is suspected; MRA or CTA may be performed first if the patients are unwilling to perform DSA. (5) Active medical treatment helps stabilizing the patients' conditions and recovering the function. In order to prevent rebleeding and secondary bleeding, a combination of the antifibrinolysis drug and calcium channel blocker may be considered. (6) The endovascular intervention, craniotomy or radiosurgery may be considered according to the cerebrovascular abnormality, patients' conditions and healthcare conditions.

Section V Cerebral venous thrombosis

I. Diagnosis

(I) Clinical characteristics

1. Mode of onset: several modes, mostly (73%) subacute (48h-30d) and chronic onset (more than 30d).
2. Clinical manifestation: complex and diverse.

(II) Auxiliary examination

1. Imaging: (1) CT; (2) MRI; (3) MRV; (4) DSA
2. Other examinations

(III) Essentials of diagnosis of thrombosis in common sites

Cavernous sinus thrombosis; superior sagittal sinus thrombosis; transverse sinus & sigmoid sinus thrombosis; great cerebral vein thrombosis.

II. Treatment

(I) Etiological treatment

(II) Symptomatic treatment

(III) Antithrombotic therapy: anticoagulation and thrombolysis

Suggestions: (1) CT scan is preferred, and MR may be performed if necessary for suspected cases, particularly the patients with high intracranial pressure of unknown origin; for the patients with clinical tentative diagnosis of sinus thrombosis, MR is preferred, and the application of MRI + MRV for comprehensive judgment seems more advantageous than DSA; DSA may be performed when interventional thrombolysis is planned. (2) After clinical diagnosis, give symptomatic treatment, actively look for the cause, and give anticoagulation based on the appropriate treatment.

Chapter VII Surgical treatment of cerebrovascular disease

Section I Hemorrhagic cerebrovascular disease

I. Spontaneous intracerebral hemorrhage

(I) Operation indication

(II) Operation contraindication

(III) Operation method

Suggestions: (1) Surgical treatment may be considered for patients with supratentorial lobar hemorrhage or putamina hemorrhage $\geq 30\text{ml}$, cerebellar hemisphere hemorrhage $\geq 10\text{ml}$, and progressive neurological deterioration, particularly young and middle-aged patients. (2) The minimally invasive operation may be performed by small bone window craniotomy or skull drilling according to the actual situation. If the

conditions permit, the CT guided, stereospecific, endoscopic or navigation technique may be adopted to obtain a good effect. (3) The advantages and disadvantages of the operation must be explained to the family members (or patients) pre-operatively, and the operation may be performed after obtaining their agreement and understanding.

II. Intracranial aneurysm

(I) Operation indication;

(II) Operation method

Suggestions: Early angiography shall be performed on SAH patients in principle, and early operative treatment shall be performed on the detected intracranial aneurysm, but shall be performed also according to the clinical conditions of the patients and particular medical conditions.

III. Cerebrovascular malformation

(I) Classification

(II) Treatment for different cerebrovascular malformations

(1) Arteriovenous malformation; (2) latent vascular malformation; (3) venous malformation

Suggestions: Adequate pre-operative evaluation shall be performed when selecting the operation treatment and determining the operation plan, including the neurological function and clinical conditions of the patients, and morphology, size and hemodynamics of the vascular malformation. The basic principles of operation shall be followed, and the attention shall be paid to the prevention and active treatment of the postoperative complications.

Section II Ischemic cerebrovascular disease

I. Indications of carotid endarterectomy (CEA)

II. Indications of percutaneous transluminal angioplasty (PTA)

III. Indications of bone flap decompressive craniectomy

Suggestions: (1) CEA treatment may be considered for patients with or without symptoms, with unilateral severe carotid artery stenosis > 70% or without response to drug treatment. Bilateral carotid artery blood flow condition shall be evaluated pre-operatively. (2) Emergency CEA treatment within 24h is not recommended for patients with acute ischemic stroke. (3) Bone flap decompression may be considered to save the life of the patient having cerebral infarction with mass effect and progressive neurological deterioration.

Chapter VIII Endovascular interventional treatment for cerebrovascular disease

Section I Intracranial aneurysm

I. Indications

II. Contraindications

III. Embolism method

IV. Postoperative management

V. Complications and management

Suggestions: (1) Generally, the endovascular intervention is mostly performed for the post-circulation aneurysm, while surgical treatment is mostly performed for posterior communicating aneurysm or middle cerebral aneurysm. The selection of endovascular intervention or surgical treatment depends on the surgeons'

proficiency of the endovascular technique and surgical technique. (2) After subarachnoid hemorrhage, cerebral angiography shall be arranged as soon as possible, and embolotherapy shall be performed during angiography in case of no very serious vasospasm.

Section II Cerebral arteriovenous malformation

I. Indications

II. Contraindications

III. Embolism method

IV. Postoperative management

V. Complications and management

Suggestions: (1) AVM (arteriovenous malformation) is easily excised by surgical operation, so endovascular intervention is not recommended generally. (2) When AVM is treated by the endovascular technique alone, the liquid embolism material, instead of solid embolism material, shall be used. (3) For AVM with arteriovenous fistula, the liquid embolism material may be injected after coiling to reduce the blood flow.

Section III Atherosclerotic cerebrovascular disease

I. Indications

II. Contraindications

III. Therapy

IV. Postoperative management

V. Complications and management suggestions:

(1) Endovascular intervention may be considered for patients with carotid artery stenosis > 70% and neurological symptoms associated with stenosis. (2) Endovascular intervention may be considered for patients with carotid artery stenosis < 70% but with obvious clinical symptoms associated with the stenosis if the conditions permit. (3) For the arteries with diameters less than 3mm, the restenosis rate post stenting is high, so special stent (such as coated stent) is recommended to reduce the incidence of restenosis. (4) Stenting for arteriostenosis treatment is a recent technique, and shall be selected with caution since there's lack of long-term follow-up results of large sample size.

Chapter IX Management of major complications

Section I Increased intracranial pressure

I. General management

II. Dehydration treatment

(1) Mannitol: 20% mannitol 125-250ml for quick intravenous drip, once every 6-8h, for 5-7 days generally. When the intracranial pressure increases significantly or brain herniation is present, a higher dose may be administrated quickly by intravenous injection for a longer time. (2) Furosemide. (3) Glycerin fructose.

III. Surgical treatment

Suggestions: (1) Dehydration treatment shall be given to patients with high intracranial pressure, and mannitol is preferred. (2) Dehydration treatment is not recommended for all cerebral stroke patients, and is not suitable for patients without increased intracranial pressure, such as lacunar infarction. (3) Surgical treatment may be considered for patients without response to dehydration or with early herniation.

Section II Blood pressure regulation

Management principles of cerebrovascular disease and hypertension: (1) Actively control excessive blood pressure. (2) Avoid reducing the blood pressure to a very low value and too quickly. (3) Closely monitor the blood pressure change, particularly in the antihypertension treatment process. (4) Blood pressure should be reduced slowly, because the automatic blood pressure adjustment function of such patients is poor, and they are prone to cerebral ischemia if the blood pressure is reduced greatly and quickly. (5) Individualized treatment shall be performed for blood pressure reduction, because the basic blood pressure of each patient is different, and they have different sensitivity to the previous antihypertensive drugs and may be combined with other different diseases. (6) Maintain the stability of antihypertensive effect, and the long-acting antihypertensive drugs are recommended generally. (7) Attention shall be paid to the protection of the target organs, such as the brain, heart and kidney, during blood pressure reduction.

Section III Pneumonia and pulmonary edema

About 5.6% of stroke patients also have pneumonia. Aspiration is the major cause of stroke with pneumonia. Disturbance of consciousness and dysphagia are major risk factors of aspiration. The mortality of 15-25% of stroke patients is caused by bacterial pneumonia. Acute cerebral stroke may be accompanied by acute pulmonary edema, and the neurogenic pulmonary edema is often seen in 30-70% of patients with severe subarachnoid hemorrhage and cerebral hemorrhage, and occasionally seen in patients with cerebral infarction. Early identification and management of swallowing issues and aspiration of stroke patients have a significant impact on the prevention of aspiration pneumonia. The treatment for pneumonia mainly includes respiratory support (such as oxygen therapy) and antibiotic therapy. As for the neurogenic pulmonary edema, etiological treatment for the primary stroke shall be performed with intracranial pressure reduction and brain cell protection as the main means.

Section IV Blood glucose change

More than half of the patients with acute cerebrovascular disease have elevated blood glucose, which may be a manifestation of diabetes mellitus or stress reaction. Hyperglycemia may be seen in patients with all types of acute cerebrovascular diseases, and its prognosis is worse than those with normal blood glucose level. Suggestions: (1) Routine blood glucose shall be performed on patients with acute stroke, and those with hyperglycemia shall be monitored. (2) Acute stroke patients with increased blood glucose shall control the blood glucose under 8.3mmol/L with insulin. (2) Hypoglycemia in acute stroke patients shall be corrected timely.

Section V Dysphagia

Forty-five percent (30-65%) of stroke patients have dysphagia on admission, about half of whom cannot recover to normal swallowing function 6 months after attack. Forty-three to fifty-four percent of stroke patients with dysphagia have aspiration. Among them, 37% further develop pneumonia, and 4% die due to pneumonia.

The treatment of dysphagia is intended to prevent aspiration pneumonia, avoid fluid loss and malnutrition due to inadequate food intake and reconstruct the swallowing function.

Section VI Upper gastrointestinal hemorrhage

The incidence of upper gastrointestinal hemorrhage is up to 30%. The severer the patients' conditions are, the higher the incidence is.

The management of upper gastrointestinal hemorrhage includes: (1) Gastric lavage: 100-200ml icy saline, add 1-2mg norepinephrine to 50-100ml saline for oral administration, and if hemostasis fails, add 1000-2000U

thrombin to another 50-100ml saline for oral administration. Reptilase, Yunnan Baiyao, Dicynone, PAMBA or somatostatin may also be used. (2) Use acid-making and hemostatic drugs: Cimetidine and Omeprazole. (3) Prevent and treat shock. (4) Gastroscopic hemostasis (5) Operation treatment.

Section VII Uracratia and urinary tract infection

Section VIII Depression and anxiety state post cerebral stroke

Suggestions: (1) Pay attention to the monitoring of the mental and emotional changes of the cerebral stroke patients, and raise the awareness of depression and anxiety state; (2) Pay attention to the psychological care of patients. In addition to active treatment of the primary diseases, rehabilitation and management of risk factors, family members, psychologists, clinicians and primary nurses may perform psychotherapy on the patients (explain, comfort, encourage and assure); eliminate existing concerns to the greatest extent and enhance the confidence of fighting the diseases according to the different conditions of patients; (3) once depression and anxiety are diagnosed, second generation antidepressants, i.e., selective serotonin reuptake inhibitors (SSRIs), are preferred, followed by the first generation antidepressants, i.e., tricyclic antidepressant (TCA); (4) psychotherapy (see above) and behavioral therapy (mainly relaxation therapy, such as biofeedback therapy, musicotherapy, yoga and Qigong) shall also be performed regardless of depression or anxiety.

Section IX Cardiac damage

Section X Acute renal failure

Section XI Fluid and electrolyte imbalance

Section XII Deep venous thrombosis and pulmonary embolism

Section XIII Stroke with epilepsy

Section XIV Bedsore

Section XV Abnormal body temperature

Chapter X Care for cerebrovascular diseases

Section I Routine emergency care

Section II Care for coma

Section III Care for paralysis

Section IV Care for upper gastrointestinal hemorrhage

Section V Care for bedsore

Chapter XI Rehabilitation of cerebrovascular diseases

The effect and importance of rehabilitation for the holistic treatment of cerebrovascular diseases have been internationally recognized. According to the data published by WHO in 1989, after stroke patients receive rehabilitation therapy, about 60% of patients may take care of themselves in activities of daily living, 20% need certain help, 15% need more help, and only 5% need all help at the end of first year, and 30% of patients at working age may work again at the end of first year post attack.

Section I Basic conditions of cerebral stroke rehabilitation

Section II Rehabilitation of major nerve malfunction

Suggestions: (1) Pay attention to early rehabilitation: early rehabilitation is very important to complication prevention and function improvement, particularly early bedside rehabilitation, such as protection and passive motion of affected limbs. They're simple, practical, easy to grasp and very effective, and all hospitals are recommended to pay full attention. (2) Emphasize continuous rehabilitation: it should be

noted that some dysfunctions may last for a long time, or even a whole life. Therefore, it's suggested to establish a continuous rehabilitation system from acute management in general hospitals to community healthcare, which is similar to the existing international cerebrovascular disease rehabilitation protocol, allowing the patients to enjoy complete rehabilitation. (3) Pay attention to psychological rehabilitation: the mental disorders of cerebrovascular disease patients are very prominent, but are often ignored. They are bad for functional rehabilitation of patients and shall be paid high attention to and treated actively. (4) Pay attention to the participation of family members: the patients will return to the family eventually; therefore, the family members play an important role in the rehabilitation of patients, and shall fully understand the patients' conditions, including dysfunctions and psychological problems for mutual adaptation and grasp certain rehabilitation means to perform necessary rehabilitation training on the patients.