# Stroke prevention

Prevention of stroke may be classified as:

- Primary prevention, if there is no previous history of stroke or transient ischaemic attack (TIA).
- Secondary prevention, if there has been such an event.

See also the separate Prevention of Cardiovascular Disease and Cardiovascular Risk Assessment articles. For tertiary prevention, see also the separate Cerebrovascular Event Rehabilitation article.

- Well-documented and modifiable risk factors for stroke include hypertension, exposure to cigarette smoke, diabetes, atrial fibrillation (AF), dyslipidaemia, carotid artery stenosis, sickle cell disease, postmenopausal hormone therapy, poor diet, physical inactivity, and obesity - especially truncal obesity. [1]
- Less well-documented or potentially modifiable risk factors include the metabolic syndrome, alcohol misuse, drug misuse, oral contraceptive use, obstructive sleep apnoea, migraine headaches, hyperhomocysteinaemia, elevated lipoprotein(a), elevated lipoprotein-associated phospholipase, and hypercoagulability. [1]
- After a stroke or TIA, there is a high risk of stroke and of other serious vascular events. Medical treatments with clear evidence of benefit include: [2]
    - Lowering blood pressure after all types of stroke or TIA.
    - Lowering blood cholesterol with a statin after ischaemic stroke or TIA.
    - Antiplatelet treatment after ischaemic stroke or TIA.

# Primary prevention[3]

## Risk assessment

- The QRISK®3 calculator has been developed specifically for the UK population. QRISK®3 includes more factors than QRISK®2 to help enable identification of those at most risk of heart disease and stroke.[4]
- QRISK®3 includes weighting for ethnicity.

## Lifestyle factors

- Dietary advice:
    - Advise eating at least five portions of fruit and vegetables per day.
    - Advise eating at least two portions of fish per week, including a portion of oily fish.
    - Advise people to eat a diet in which the total fat intake is 30% or less of total energy intake, saturated fats are 7% or less of total energy intake, dietary cholesterol is less than 300 mg/day, and saturated fats are replaced by mono-unsaturated and polyunsaturated fats.
    - Advise pregnant women to limit their intake of oily fish to two portions a week.
    - Advise people to reduce their intake of sugar and food products containing them, and to choose wholegrain varieties of starchy foods.
    - Do not routinely recommend omega-3 fatty acid supplements or plant sterols and stanols for primary prevention.

- Physical activity:
    - Advise people to take 30 minutes of at least moderate-intensity exercise a day at least five days a week.
    - Encourage people who cannot manage this to exercise at their maximum safe capacity.
    - Recommend exercise that can be incorporated into everyday life, such as brisk walking, using stairs and cycling.
    - Tell people that they can exercise in bouts of 10 minutes or more throughout the day.
    - Take into account the person's needs, preferences and circumstances.
    - Agree goals and provide written information about the benefits of activity and local opportunities to be active.
- Weight management:
    - Offer people who are overweight or obese advice and support to work towards achieving and maintaining a healthy weight.
- Alcohol consumption:
    - Advise men and women to limit alcohol intake to no more than 14 units a week.
    - Advise everyone to avoid binge drinking.
- Smoking cessation:
    - Advise all people who smoke, to stop.
    - If people want to stop:
        - Offer support and advice.
        - In addition, provide medication to help with smoking cessation when indicated.

## Drug treatment

Before starting statin therapy, offer people the opportunity to change their lifestyle and reassess their risk.[3]

See also the separate Atrial Fibrillation article for more information about the prevention of strokes in people with AF. AF is responsible for 25% of all strokes.[5]

### Hypertension

- Screen for hypertension and treat appropriately according to National Institute for Health and Care Excellence (NICE) guidelines.[6]

### Antithrombotic treatment

- Following acute myocardial infarction (MI): anticoagulation is appropriate in those who are at increased risk of thromboembolism, including those with a large anterior MI, left ventricular aneurysm or thrombus, paroxysmal tachyarrhythmias, chronic heart failure or a history of thromboembolic events.[7]
- Anticoagulation is indicated for other cardiovascular risk factors for thromboembolism - eg, prosthetic valves, rheumatic heart disease and AF. Anticoagulation instead of antiplatelet treatment should be used for patients who have AF and no contra-indications to anticoagulation.[1]

### Aspirin

- Aspirin produces a 12% proportional reduction in serious vascular events, mainly due to a 20% reduction in non-fatal MI. There was no net effect on stroke and vascular mortality.[8]
- If low-dose aspirin is used in primary prevention, the balance of risk and benefits should be discussed with the patient.
- The risk of gastrointestinal bleeding probably outweighs the small benefit in stroke prevention unless the risk of stroke is particularly high.

### Lipid-lowering drugs[3]

- Consider the possibility of familial hypercholesterolaemia (FH) and investigate as appropriate if total cholesterol is over 7.5 mmol/L and there is a family history of premature CHD.
- NICE recommends statin therapy as part of the management strategy for the primary prevention of CVD for adults who have a 20% or greater 10-year risk of developing CVD .
- Total, HDL and non-HDL cholesterol should be measured in all people started on high-intensity statins, including 20 mg atorvastatin, three months after treatment commencement. Aim for a greater than 40% reduction in non-HDL cholesterol. If not achieved:
    - Discuss adherence and timing of dose.
    - Optimise diet and lifestyle measures.
    - Consider increasing dose if started on less than atorvastatin 80 mg and the person is judged to be at higher risk because of comorbidities, risk score or using clinical judgement.

### Atrial fibrillation (AF) [9]

See also the separate Atrial Fibrillation article for more information about the prevention of strokes in people with AF. AF is responsible for 25% of all strokes. [5]

- All patients with AF should be assessed for their risk of stroke and the need for thromboprophylaxis balanced with the patient's risk of bleeding.
- NICE recommends using the $CHA_2DS_2$-VASc assessment tool for stroke risk and the ORBIT tool for bleeding risk prior to and during anticoagulation.
- Risk factors for stroke included in $CHA_2DS_2$-VASc include prior ischaemic stroke, TIAs or thromboembolic events, heart failure, left ventricular systolic dysfunction, vascular disease, diabetes, hypertension, females and patients over 65 years.
- Patients with a very low risk of stroke ($CHA_2DS_2$-VASc score of 0 for men or 1 for women) do not require any antithrombotic therapy for stroke prevention.

- Oral anticoagulation should be offered to patients with confirmed diagnosis of AF in whom sinus rhythm has not been successfully restored within 48 hours of onset, patients who have had or are at high risk of recurrence of AF (eg, structural heart disease, prolonged history of AF longer than 12 months), a history of failed attempts at cardioversion, and patients with a greater risk of stroke than risk of bleeding.
- Oral anticoagulation is with a vitamin K antagonist (eg, warfarin or, in non-valvular AF, with apixaban, dabigatran etexilate, rivaroxaban or edoxaban.
- Anticoagulants are also indicated during cardioversion procedures.
- Aspirin is less effective than oral anticoagulation and the modest benefit is offset by the risk of bleeding. Therefore, aspirin should not be offered as monotherapy for stroke prevention in AF.
- If anticoagulant treatment is contra-indicated or not tolerated, left atrial appendage occlusion can be considered.

## Secondary prevention of stroke and transient ischaemic attacks[10]

- People with a suspected TIA should be offered aspirin 300 mg a day, to be started immediately.
- All people who have a suspected TIA should be referred immediately for specialist assessment and seen within 24 hours.
- All patients should be given appropriate advice on lifestyle factors as described for primary prevention, including smoking cessation, physical activity, diet, weight control and avoiding excess alcohol.
- All patients should receive regular review and treatment of risk factors for vascular disease for the rest of their lives after a stroke with inclusion on a stroke register and a minimum of annual follow-up.
- Blood pressure: see the separate Hypertension Treatment article.

- Antithrombotic treatment:
    - People with acute stroke should be started on 300 mg aspirin daily for two weeks once intracerebral haemorrhage has been excluded. At this time a definitive longer antithrombotic treatment plan should be implemented.
    - An alternative antiplatelet should be offered to anyone who is allergic to or genuinely intolerant of aspirin
    - If there is a history of persistent or paroxysmal AF in a non-haemorrhagic stroke, consider anticoagulation first-line:
        - Anticoagulation should be started in every patient with persistent or paroxysmal AF (valvular or non-valvular) unless contra-indicated, following an initial two-week course of aspirin 300 mg daily.
        - Anticoagulation is indicated for other cardiovascular risk factors for thromboembolism - eg, prosthetic valves.[1] Anticoagulation should be stopped for one week following diagnosis of cerebral infarction in people with prosthetic valves if there is a significant risk of haemorrhagic transformation. During this week, 300 mg aspirin should be substituted.
        - Anticoagulants should not be started until brain imaging has excluded haemorrhage and usually not until 14 days have passed from the onset of an ischaemic stroke.
    - Patients with TIA or ischaemic stroke (not due to AF) should be on clopidogrel (only use modified-release dipyridamole in combination with aspirin if clopidogrel is not tolerated).[11] [12] Clopidogrel is also the preferred treatment option in patients with peripheral arterial disease or multivascular disease.[13]
    - Dual therapy with aspirin and clopidogrel may be initiated in secondary care for the first three months following ischaemic stroke or TIA due to severe symptomatic intracranial stenosis or for another condition such as acute coronary syndrome.[12]

- Anti-lipid agents:
    - Treatment with a statin should be given to all patients with ischaemic stroke or TIA unless contra-indicated.[3]
    - Following an ischaemic stroke or TIA with evidence of atherosclerosis, people with a target LDL cholesterol of less than 1.8 mmol/L (70 mg/dL) have a 22% lower risk of subsequent cardiovascular events than those with a target LDL of 2.3 mmol/L (90 mg/dL).[14]

**Carotid endarterectomy for people with carotid artery stenosis**

Carotid endarterectomy has been the standard in atherosclerotic stroke prevention but carotid artery stenting has emerged as a less invasive alternative for revascularisation.[15] See also the separate Carotid Artery Stenosis article.

- Carotid endarterectomy:
    - All people who have a TIA should have consideration given at their specialist assessment of their suitability for carotid endarterectomy. If they are considered as a possible candidate, they should have urgent carotid imaging.[10]
    - People with stable neurological symptoms from acute non-disabling stroke or TIA who have symptomatic carotid stenosis of 50-99% according to the North American Symptomatic Carotid Endarterectomy Trial (NASCET) criteria, or 70-99% according to the European Carotid Surgery Trialists' (ECST) Collaborative Group criteria, should:
        - Be assessed and referred urgently for carotid endarterectomy to a service following current national standards.
        - Receive best medical treatment (control of blood pressure, antiplatelet agents, cholesterol lowering through diet and drugs, lifestyle advice).[10]
    - People with stable neurological symptoms from acute non-disabling stroke or TIA who have symptomatic carotid stenosis of less than 50% according to the NASCET criteria, or less than 70% according to the ECST criteria, should:
        - Not undergo surgery.
        - Receive best medical treatment (control of blood pressure, antiplatelet agents, cholesterol lowering through diet and drugs, lifestyle advice).[10]
    - Carotid endarterectomy is of some benefit for patients with 50-69% symptomatic stenosis and is very beneficial for 70-99% stenosis.[16]
    - Carotid endarterectomy for asymptomatic carotid stenosis reduces the risk of any stroke by approximately 30% over three years. However, the absolute risk reduction is small and there is a 3% perioperative stroke or death rate.[17]

    - A Cochrane review found that:[18]
        - Stenting for symptomatic carotid stenosis is associated with a higher risk of periprocedural stroke or death than endarterectomy. This extra risk is mostly an increase in minor, non-disabling strokes occurring in people older than 70 years.
        - Beyond the periprocedural period, carotid stenting is as effective in preventing recurrent stroke as endarterectomy.
        - However, combining procedural safety and long-term efficacy in preventing recurrent stroke still favours endarterectomy.
        - The review also found that, in people with asymptomatic carotid stenosis, there may be a small increase in the risk of periprocedural stroke or death with stenting compared with endarterectomy.
- Carotid angioplasty and stenting:
    - Endovascular treatment and carotid endarterectomy appear to have similar early risks of death or stroke and similar long-term benefits in the treatment of carotid artery stenosis.[17]
    - For patients with symptomatic carotid stenosis, the functional outcome after stenting is similar to endarterectomy, but stenting is associated with a small increase in the risk of non-disabling stroke.[19]

## Further reading

- Cardiovascular disease prevention; NICE Public Health Guideline (June 2010)
- The Stroke Association
- Blood Pressure Association
- Transcervical extracorporeal reverse flow neuroprotection for reducing the risk of stroke during carotid artery stenting; NICE Interventional Procedure Guidance, June 2016

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