MODULE 8: SECONDARY STROKE PREVENTION

Learning Objectives

Upon completion of this module, nurses will be able to:

- Explain modifiable and non-modifiable risk factors
- Identify key aspects of secondary stroke prevention
- Identify best practices for carotid stenosis interventions
- Identify commonly prescribed medications for stroke and stroke prevention
- Understand Transient Ischemic Attack 'TIA'
- Explain the role of the secondary prevention clinic
- Describe the prevention of recurrent stroke in pregnancy
- Learn key points for teaching stroke patients about their medications

The content in this chapter has been adapted from the *2017 Canadian Stroke Best Practice Recommendations: Secondary Prevention of Stroke* (see reference list for details).

Supplementary references and guidelines are identified at the relevant subsections.

SWO Stroke Network, 2018.
Adapted from NEO Stroke Network (2010).

The Canadian Stroke Best Practice Recommendations: Secondary Prevention of Stroke Core Element of Stroke Prevention Services Underlying Framework

The following diagram outlines the services that contribute to secondary stroke prevention. As a nurse, you have a role in a number of these core elements.

8.1 Stroke Prevention and Risk Factor Management

Primary stroke prevention is an individually based clinical approach to disease prevention. It targets otherwise healthy individuals with modifiable risk factors to prevent the initial occurrence of a disease. It is typically implemented in the primary care setting.

Secondary stroke prevention is an individually based clinical approach to reduce the risk of further vascular events in:

- An individual who has experienced a stroke or transient ischemic attack (TIA)
- An individual who is at high risk of stroke due to underlying medical conditions or risk factors

(Heart and Stroke Foundation of Canada, 2017
Canadian Stroke Best Practice Recommendations: Secondary Prevention of Stroke)

Stroke Risk Factors

Non-modifiable stroke risk factors are those over which an individual has no control:

- Age – stroke can occur at any age, but after age 55 the risk of stroke doubles in each successive decade
- Gender – after menopause, stroke is more prevalent in women; otherwise, stroke is more prevalent in men
- Race/ethnicity – stroke is more prevalent in Indigenous, African, and South Asian heritage
- Family history – you are more likely to have a stroke if you have a first degree relative (parents, sibling, or children) with a history of stroke prior to the age of 65
- Previous TIA or stroke

A stroke risk profile that includes non-modifiable risk factors can be balanced out or offset by effective management of risk factors that are modifiable.

Modifiable risk factors are those over which an individual has some control, or those factors s/he can modify in order to reduce the risk of stroke.

With medical supervision/management:

- Hypertension
- Diabetes
- Hyperlipidemia
- Atrial Fibrillation
- Cardiac Disease
- Oral Contraceptives and Hormone Replacement Therapy

Through self-management (and with medical support, if needed):

- Healthy diet
- Sodium intake
- Physical inactivity
- Obesity
- Excessive alcohol consumption
- Smoking
- Recreational Drug Use

Preventative measures aimed at reducing risk factors will not only prevent strokes but will also prevent other chronic diseases which share similar risk factors.

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8 out of 10 individuals have at least one of the following risk factors while 1 out of 10 has three or more:

- *smoking*
- *physical inactivity*
- *obesity*
- *hypertension*
- *diabetes*

Lifestyle and Risk Factor Management

(Adapted from the 2017 Canadian Stroke Best Practice Recommendations: Secondary Prevention of Stroke)

Persons at risk of stroke and patients who have had a stroke should be assessed for vascular disease risk factors and lifestyle management issues. They should receive information and counselling about possible strategies to modify their lifestyle and risk factors. Referrals to appropriate specialists should be made where required to provide more comprehensive assessment and structured programs to manage risk factors.

- Healthy Balanced Diet
- Sodium
- Exercise
- Weight
- Alcohol Consumption
- Oral Contraceptives and Hormone Replacement Therapy
- Recreational Drug Use

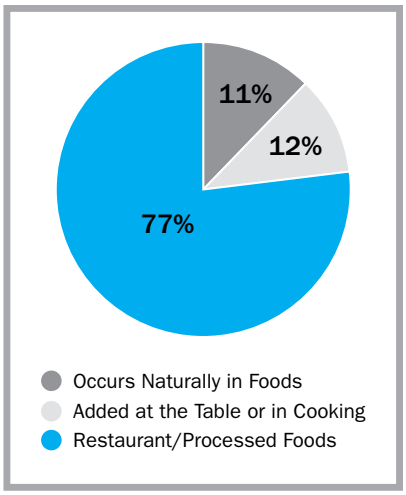
Healthy Balanced Diet

- Should be in accordance with *Canada's Food Guide to Healthy Eating*
- High in fruits, vegetables, low fat dairy products, dietary and soluble fibre, whole grains and lean meats or protein from plant sources
- Low in saturated fat, cholesterol (less than 200 mg/day) sodium
- Low in free sugars (less than 10% of daily caloric intake), which includes sugars added to processed foods, fruit juices, soft drinks, honey, and syrups
- The Dietary Approaches to Stop Hypertension (DASH) diet and Mediterranean diet have been shown to reduce stroke risk

Sodium

- Limit sodium intake from all sources.
- The adequate sodium intake for most adults is 2000 mg per day (this is only 1 teaspoon!)
- The average daily sodium intake is well beyond the upper limit.
- Most of our sodium intake (approximately 80%) is hidden in processed or pre-prepared foods.
- Simply getting rid of the salt shaker is not enough!

Research suggests that reducing sodium intake to the recommended levels could lower the incidence of stroke and cardiac disease by as much as 30% as well as have a significant impact on reducing blood pressure. Becoming familiar with reading nutrition labels will help to make healthy food choices and reduce sodium intake.



Adapted from Mattes and Donnelly, 1991

Recommended Sodium Intake

Average Daily Sodium Intake	Recommended daily sodium limit by age range	Upper limit for sodium intake by age range
Approximately 3,500 mg	19-50: 2,000 mg 51-70: 2,000 mg 71+: 2,000 mg	19-50: 2,300 mg 51-70: 2,300 mg 71+: 2,300 mg

Adapted from Canadian Hypertension Education Program Recommendations, Hypertension Canada, 2014

Exercise

- Moderate exercise (brisk walking, jogging, cycling, swimming) 4 to 7 days per week
- A weekly accumulation of 150 minutes of moderate activity in a minimum of 10 minute segments
- Most stroke patients should be encouraged to start a regular exercise program
  - Exercise programs supervised by health and/or medical professionals are recommended for high risk patients (e.g. those at risk of falls or with co-morbid conditions such as cardiac disease)
  - The AEROBICS Guidelines support healthcare professionals to safely guide people with stroke and TIA resume physical activity

The benefits of physical activity include better lipid values, especially high density lipoproteins (HDL) and triglycerides (TG), better blood glucose control, a lower blood pressure (BP), more energy, lower stress level, weight control, and an improved immune system.

Weight

- Maintain goal of a body mass index (BMI) of 18.5 to 24.9 kg/m^2 (BMI is weight divided by height squared)
  - Overweight defined as a BMI between 25-30
  - Obesity BMI greater than 30
  - Stroke risk increases significantly for those with a BMI in the overweight or obese ranges
  - Maintain a healthy waist circumference:
    – Men less than 102 cm
    – Women less than 88 cm

	Higher Risk of Stroke	Significantly Higher Risk of Stroke
Men	Greater than 94 cm	Greater than 102 cm
Women	Greater than 80 cm	Greater than 88 cm

Adapted from Heart and Stroke Foundation: Healthy Weight and Waist, 2018 and the 2017 Canadian Stroke Best Practice Recommendations: Secondary Prevention of Stroke

- Please refer to the chart below for target waist circumference for those of various ethnic descents:

Country or Ethnic Descent	Target the Waist Circumference equal to or less than…	
	Men	Women
European	94 cm	80 cm
South Asian, Chinese	90 cm	80 cm
Japanese	85 cm	90 cm
South and Central American	Use South Asian cut-off points listed above until more specific data are available	
Sub-Saharan African, Eastern Mediterranean and Middle East (Arab)	Use European cut-off points listed above until more specific data are available	

Table adapted from Lau et al., 2007

Waist circumference is an index of the absolute amount of abdominal fat.

Abdominal obesity should be measured, as it plays a critical role in the etiology of metabolic syndrome (increased waist circumference, raised triglycerides, decreased HDL, increased blood pressure and raised fasting glucose).

Clear evidence exists that obese individuals are at increased risk of health problems, including stroke, heart disease, type 2 diabetes, osteoarthritis and certain cancers (2006 Canadian Clinical Practice Guidelines on the Management and Prevention of Obesity in Adults and Children).

Alcohol Consumption

Recommendations include two or fewer standard drinks per day

- Fewer than 15 drinks per week for men
- Fewer than 10 drinks per week for women who are not pregnant

**A standard drink is 5 oz (148 mL) of wine, 12 oz (355 mL) of beer or 1.5 oz (44 mL) of spirits.*

Heavy and/or binge drinking (more than 4 drinks per day for men and 3 drinks per day for women) have been associated with an increased risk of stroke. *(Canadian Centre on Substance Abuse, 2013).*

Oral Contraceptives and Hormone Replacement Therapy

Evidence shows that hormone replacement therapy and high or low dose estrogen-containing oral contraceptives increases the risk of ischemic stroke. Research suggests that high dose transdermal contraceptive therapy has been shown to increase the risk of stroke. Therefore, their use should be discouraged or discontinued in patients with stroke or TIA.

Alternative medical management should be considered in patients taking estrogen-containing oral contraceptives or hormone replacement therapy in the presence of stroke or TIA.

Recreational Drug Use

The use of recreational drugs can trigger mechanisms in the body that increase the risk of stroke, including “hypertensive surges, vasospasm, enhanced platelet aggregation, vasculitis, accelerated atherosclerosis, and cardioembolism” (Wein et al, 2017, p. 37). Cocaine, amphetamines, Ecstasy, heroin/opiates, phencyclidine (PCP), lysergic acid diethylamide (LSD), and cannabis/marijuana are the drugs linked to increased stroke risk.

Individuals who have experienced a stroke or TIA and are known to use recreational drugs should be encouraged to stop if they are not prescribed for medical reasons. Appropriate support and referrals to services and resources for drug addiction and rehabilitation should be offered.

8.2 Smoking Cessation

Cigarette smoking causes more deaths in Canada from heart disease and stroke than cancer *(HSF0, 2000)*. Smoking doubles the risk of ischemic stroke and is associated with a 2-4 fold increase in hemorrhagic stroke (Goldstein et al., 2011).

A large proportion of Canadian current smokers have been shown to be willing to make a quit attempt. Healthcare providers have an important role in assisting individuals to quit smoking with even brief interventions proving effective in prompting quit attempts.

Female patients who smoke and take oral contraceptives or estrogen-based hormone replacement therapy are at an increased risk of initial or recurrent stroke.

Management of Smoking Cessation

- Follow the 5 A's Model for Treating Tobacco Use and Dependence (see below)
- Smoking status should be identified, assessed and documented
- Provide clear, non-judgemental, and patient-specific advice regarding the importance of smoking cessation
- A combination of pharmacotherapy and behavioural therapy is recommended (see below)
- For inpatients who are current smokers: follow protocols for the management of withdrawal symptoms during hospitalization
- Offer motivational intervention to support the readiness to quit in those who demonstrate reluctance or uncertainty

Integrating Smoking Cessation into Daily Nursing Practice

(Nursing Best Practice Guidelines, visit www.tobaccofreernao.ca)

- Window of opportunity in the hospital setting to intervene or at least introduce the notion of not resuming tobacco on discharge
- Nurses could implement minimal tobacco use intervention using the *"Ask, Advise, Assess, Assist, Arrange"* protocol with all clients

"5 A's" Model for Treating Tobacco Use and Dependence

ASK about tobacco use	Identify and document tobacco use status for every patient at every visit.
ADVISE to quit	In a clear strong, and personalized manner, urge every tobacco user to quit.
ASSESS willingness to make a quit attempt	Is the tobacco user willing to make quit attempt at this time?
ASSIST in quit attempt	For the patient willing to make a quit attempt, offer medication and provide or refer for counselling or additional treatment to help the patient quit. For patients unwilling to quit at the time, provide interventions designed to increase future quit attempt.
ARRANGE follow-up	For the patient willing to make a quit attempt, arrange for follow-up contacts, beginning within the first week after the quit date For patients unwilling to make a quit attempt at the time, address tobacco dependence and willingness to quit at the next visit.

Adapted from RNAO, 2007

Smoking Cessation Interventions:

- Pharmacotherapy
  - Nicotine Replacement Therapy (NRT) (patch, gum, inhaler, lozenges, nasal spray)
  - Nicotine Receptor Partial Agonists (Varenicline - Champix)
  - Bupropion SR
- Counseling
- Smoker's helpline (visit www.smokershelpline.ca)

Withdrawal symptoms include: initially anger, impatience, restlessness, difficulty concentrating, insomnia, increased appetite and anxiety and depressed mood. Symptoms can begin a few hours after last cigarette and peak 2-3 days later and continue over a period 2-3 weeks (American Psychiatric Association, 2013).

The goal of NRT is to assist in the transition from smoking to abstinence by decreasing withdrawal symptoms and motivation to smoke (Stead et al, 2009-Cochrane Review).

8.3 Blood Pressure Management

(Adapted from the 2017 CBSPR and the 2017 Hypertension Canada Recommendations for the Management of Hypertension)

- Hypertension is the single most important, modifiable risk factor for stroke.
- Blood pressure should be monitored in all persons at risk for stroke.

Approximately 20-30% of adults have high blood pressure as do 60% of those over age 65, and 70% in those who have experienced a stroke (Du et al., 2000). Each 2mmHg reduction of systolic blood pressure is linked to a 25% reduction in stroke events (Girerd and Giral, 2004).

In Canada, 22.6% of the adult population has hypertension and, of that group, the hypertension was controlled in 68.1% (67.1% of those who also had diabetes). (Padwal et al., 2015)

Hypertension Canada Recommendations for the Management of Hypertension state that:

- Blood pressure should be checked with each encounter with the healthcare system.
- A comprehensive treatment plan includes lifestyle modification, pharmacotherapy and ongoing monitoring.

Recommendations for the Management of Blood Pressure

Population	Recommended Treatment Target
Individuals who have had a stroke/TIA	Less than 140/90mmHg
Individuals with stroke/TIA and with diabetes	Less than 130/80mmHg
Individuals with stroke/TIA and non-diabetic chronic kidney disease	Less than 140/90mmHg
Individuals who experienced a small, subcortical stroke	Less than 130mmHg systolic target
In individuals with coronary artery disease be cautious when lowering blood pressure if diastolic blood pressures are less than 60mmHg	
Non-stroke/TIA targets:	Diabetes: Less than 130/80 mmHg All others: Less than 140/90 mmHg *individualized according to each person's unique risk factor profile

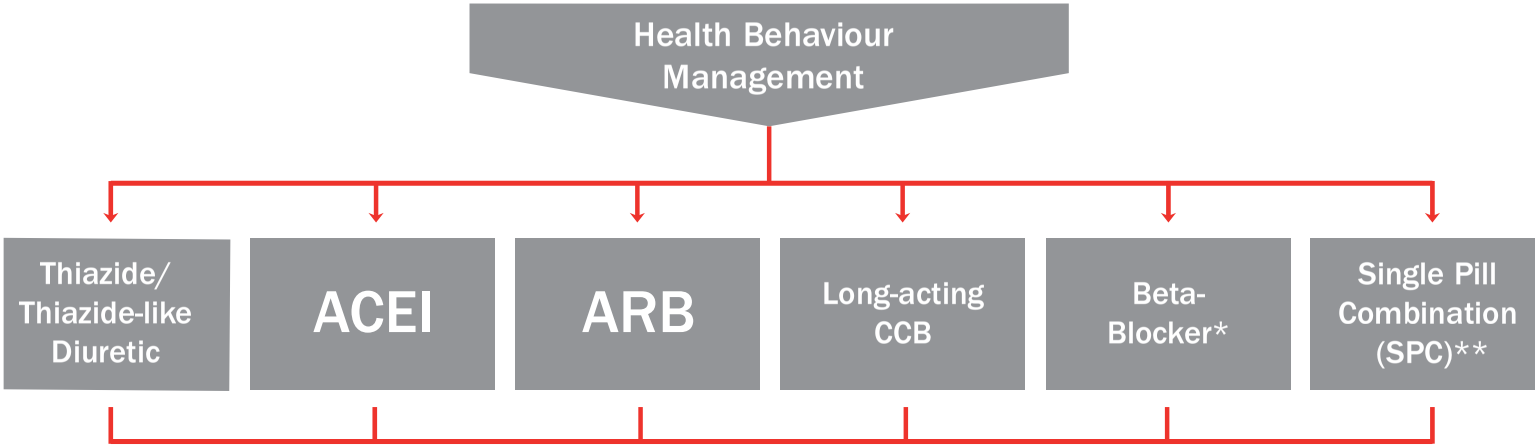
Table adapted from the 2017 Hypertension Canada Recommendations for Management of Blood Pressure and 2017 Canadian Stroke Best Practice Recommendations Secondary Prevention of Stroke

Ideally, the targets should be even lower than shown in the table. Studies are underway to better define the appropriate lower target rate for stroke patients.

Patients found to have elevated blood pressure (systolic greater than 130mmHg and/or diastolic greater than 85mmHg) should undergo a thorough assessment for the diagnosis of hypertension.

Lifestyle management is a critical component of hypertension management.

Pharmacological Treatment of Hypertension



*Beta-Blockers are not indicated as first line therapy for age 60 and above

**Recommended SPC choices:
ACE-I + CCB
ARB + CCB
ARB + Diuretic
ACE-I + Diuretic

Renin Angiotension System (RAS) inhibitors are contraindicated in pregnancy and caution is required in prescribing to women of child bearing potential

ACE-I = Angiotension-converting enzyme inhibitors

ARB = Angiotension II Receptor Blockers

CCB = Calcium Channel Blocker

Single pill combination (SPC) is when then manufacturer combines multiple formulas into one tablet. This is easier for patients while also assisting with medication taking compliance.

Adapted from Hypertension Canada 2014 Canadian Hypertension Education Program Recommendations

Common mediation categories for hypertension include:

- Thiazide-like **Diuretic** such as Hydrochlorothiazide and Indapamide
- **ACEI** (Angiotensin Converting Enzyme Inhibitor) such as Ramipril and Perindopril
- **ARB** (Angiotensin II Receptor Blocker) such as Diovan or Avapro
- **Long-acting CCB** (Calcium Channel Blocker) such as Cardizem and Norvasc
- **Beta-Blocker** such as Metoprolol or Atenolol

These have all been shown to reduce recurrent stroke and other vascular events. Most patients with stroke or TIA will benefit from treatment with a blood pressure lowering agent, regardless of the presence of hypertension.

There is less evidence on the role of beta blockers and calcium channel blockers in the secondary prevention of stroke, but there may be some benefit. Research is still in progress regarding the effectiveness of direct renin inhibitors (e.g., aliskiren) in the prevention of stroke.

For secondary prevention, aggressive treatment of blood pressure to targets is of greater benefit than more modest reductions.

There is a lack of randomized controlled trials that define the optimal time to initiate blood pressure lowering therapy after acute stroke or TIA – **each case must be assessed individually.**

Another recommended resource:

RNAO Nursing Management of Hypertension (revised 2009)

Manual includes:

- The detection and diagnosis of hypertension
- Using correct cuff size
- Education for patients about home BP monitoring
- Education for patients on their target BP and importance of achieving this target
- Assessment and Development of a Treatment Plan:
  - Lifestyle interventions: help to identify lifestyle factors which may influence hypertension management
  - Diet: instruct DASH diet (Dietary Approaches to Stop Hypertension)
  - Healthy weight: weighing patients, calculating BMI and measuring waist circumference
  - Exercise guidelines
  - Alcohol consumption
  - Smoking cessation
  - Stress reduction

http://rnao.ca/bpg/guidelines/nursing-management-hypertension

8.4 Lipid Management

Dyslipidemia is a modifiable risk factor for atherosclerosis in which screening is imperative in order to identify risk and institute appropriate therapy for both primary and secondary prevention of coronary artery disease (CAD), peripheral artery disease (PAD), and stroke. (Adams et al., 2009)

Every 1.0 mmol/L reduction in Low Density Lipoprotein cholesterol (LDL) is associated with a reduction in major cardiovascular events by approximately 20%. Lowering LDL by 2-3mmol/L would lower this risk by 40-50%. (Cholesterol Treatment Trialists Collaboration, 2010)

Lipid Assessment

- Lipid levels (total cholesterol, total triglycerides (TG), low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol) should be measured on all patients presenting with stroke or TIA.
- People of Indigenous or South Asian descent are at an increased risk for dyslipidemia.
- Considered in the high risk category is any patient with a diagnosis of CAD, peripheral vascular disease, aortic aneurysm, cerebrovascular disease (including TIA), and most adult patients with type 1 or type 2 diabetes mellitus.
- It is extremely important to implement the healthy lifestyle modifications outlined earlier to lower overall risk as an integral part of the management plan.
- Ischemic stroke patients should be treated to achieve a target of LDL less than 2.0 mmol/L or a greater than 50% reduction from their baseline LDL cholesterol level; treatment includes pharmacotherapy and aggressive lifestyle modification, including dietary guidelines.
- Individuals with coronary artery disease or recent acute coronary syndrome should be considered for a more aggressive target of of <1.8 mmol/L or a greater than 50% reduction from baseline.
- Statin therapy is not routinely indicated for stroke prevention in the instance of intracerebral hemorrhage.

Pharmacological Treatment of Dyslipidemia

Statins

- Atorvastatin (Lipitor)
- Rosuvastatin (Crestor)
- Simvastatin (Zocor)
- Pravastatin (Pravachol)
- Fluvastatin (Lescol)

Statin agents should be prescribed for most patients who have had an ischemic stroke or transient ischemic attack to achieve current recommended lipid levels.

Possible effects include the following:

- anti-inflammatory properties may help stabilize the lining of blood vessels
- may help relax blood vessels thus contributing to lower blood pressure
- may have a blood thinning effect thus reducing the risk of blood clots

Pro-Protein Convertase Subtillsin-Kexin Type 9 (PCSK9) Inhibitors

- Evolocumab (Repatha)
- Alirocumab (Praluent)

These monoclonal antibodies are newer medications that reduce LDL. They inhibit an enzyme that destroys the LDL receptors which are used to metabolize LDL.

No recommendations have yet been made about the addition of these agents to standard statin therapy in the *2017 Canadian Best Practice Recommendations: Secondary Prevention of Stroke.*

Additional medications that are used in dyslipidemia management:

- Ezetimibe – Lowers LDL and is prescribed primarily in conjunction with statins
- Fibrates (i.e., fenofibrate, bezafibrate, etc.) – reduce triglyceride levels

8.5 Diabetes Management

(Adapted from the *2017 CSBPR and the 2013 Canadian Diabetes Association Clinical Practice Guidelines (Updated November 2016*)

Diabetes is a major, independent risk factor for stroke and most adults with type 1 or 2 diabetes should be considered at high risk for vascular disease. It is a particularly strong risk factor in younger patients, and as much as tenfold in some subgroups.

Diabetes increases the risk of ischemic stroke more than hemorrhagic stroke.

Many patients may exhibit metabolic syndrome and additional risk factors such as hypertension, hyperdyslipidemia which further increase the risk of TIA/stroke.

Reducing risk factors to target levels is essential and involves a multi-issue approach, including lifestyle modifications, tight glycemic control, antiplatelet drugs, control of lipid levels and blood pressure control.

Diabetes Assessment and Stroke

The Canadian Diabetes Association Clinical Practice Guidelines recommend screening every three years for individuals aged 40 or older or those at high risk. The high risk group includes those who have experienced a stroke. The guidelines also state that individuals with additional risk factors for diabetes should be screened earlier and more often.

The Canadian Stroke Best Practice Recommendations suggest the following screening and assessment:

- Patients without a known history of diabetes:
  - Fasting plasma glucose, or
  - 2 hour plasma glucose, or
  - Glycated hemoglobin (A1C), or
  - 75 g oral glucose tolerance test
- Patients with known history of diabetes
  - Glycated hemoglobin (A1C)

Diabetes Management in Secondary Stroke Prevention

Managing risk factors to target levels is essential and involves a multi-issue approach, including lifestyle modifications, tight glycemic control, antiplatelet drugs (aspirin), control of lipid levels and blood pressure control.

- The recommended targets for glycemic control are (individualized as needed):
  - A1C (Glycated Hemoglobin) equal to or less than 7.0 %
  - FPG (Fasting Plasma Glucose) = 4.0-7.0 mmol/L
  - 2 hour PG (Plasma Glucose) = 5.0-10.0 mmol/L OR 5.0-8.0 mmol/L if A1C targets are not being achieved

Adults at high risk of a vascular event should be treated with a statin to achieve an LDL equal to or less than 2.0 mmol/L.

- Unless contraindicated, ASA therapy (80-325mg/day) is recommended in all patients with diabetes with evidence of cardiovascular disease such as stroke.
- Treat to the diabetes targets identified below.

The following Recommendations for Vascular Protection are appropriate for all patients with diabetes:

The ABCDEs:

A A1C – optimal glycemic control (usually less than or equal to 7%)

B BP – optimal blood pressure control (less than 130/80 mmHg)

C Cholesterol – LDL-C of less than or equal to 2.0 mmol/L if decision made to treat

D Drugs – to protect the heart (see below)

A – ACE Inhibitor or ARB

S – Statin

A – ASA, if indicated

E Exercise/Eating – regular physical activity, healthy diet, achievement and maintenance of healthy body weight

S Smoking – cessation

Medications

- For individuals with cerebrovascular and carotid disease, regardless of age
- Statin (with additional lipid therapy, if indicated)
- ACE Inhibitor or ARB
- ASA (or clopidogrel if ASA-intolerant)

(Canadian Diabetes Association, 2013 Clinical Practice Guidelines Quick Reference Guide (Updated November 2016), pages 5-6)

8.6 Antiplatelet Therapy

All patients with ischemic stroke or transient ischemic attack should be prescribed antiplatelet therapy for secondary prevention of recurrent stroke unless there is an indication for anticoagulation.

- Antiplatelet agents are considered a fundamental component of secondary stroke prevention.
- There is a 25% relative risk reduction in recurrent stroke for patients treated with ASA (Saxena and Koudstaal, 2004).
- For adult patients on ASA, the usual maintenance dosage is 81 mg/day, unless other indications are present which may suggest a higher dose is required.
- There is also some evidence to support the use of alternative antiplatelet agents including extended-release dipyridamole plus ASA or clopidogrel.
- Long-term use of combinations of aspirin and clopidogrel are not recommended (greater than 90 days), unless there is an alternate indication.
- Aspirin (ASA) (81-325 mg), combined ASA (25 mg) and extended release dipyridamole (200 mg) [Aggrenox], or clopidogrel (75 mg) [Plavix] may be used depending on the clinical circumstances. (ie. cardiac stent, etc.)

8.7 Antithrombotic Therapy for Atrial Fibrillation

(Adapted from the *2017 CSBPR and the 2016 Canadian Cardiovascular Society Atrial Fibrillation Guidelines)*

Atrial Fibrillation is a significant risk factor for stroke and should be aggressively managed to reduce the risk of cerebrovascular events.

- Atrial fibrillation is detected through 12-lead ECG, 24-hour ECG, and/or 2-week (or longer) monitoring.
- Patients with atrial fibrillation or atrial flutter (paroxysmal, persistent or permanent) should be screened using a predictive tool (i.e., the $CHADS_2$, $CHADS_2$-Vasc, or CHADS65) and for the risk of bleeding (i.e., the HAS-BLED). The CHADS65 is the tool promoted by the 2016 Canadian Cardiovascular Society Atrial Fibrillation Guidelines.
  - Note: for more information on these predictive tools, please refer to the guidelines section at www.ccs.ca
- Patients with atrial fibrillation who experienced a stroke or TIA should receive anticoagulation* according to the CHADS65 (*unless contraindicated on an individualized basis)

The choice of medication is based on patient factors including age, renal function, additional health factors, likelihood of compliance, patient preferences, presence of a mechanical heart valve, and costs.

Oral Anti-Coagulation (OAC):

- Most patients should receive a novel OAC (NOAC) / direct OAC (DOAC):
  - dabigatran
  - rivaroxaban
  - apixaban
  - edoxaban
- Patients with atrial fibrillation who also have a mechanical heart valve must be placed on warfarin according to the best practice guidelines.

- Patients with atrial fibrillation who are already well controlled on warfarin with a stable INR (70% of the time as per documented INR) may continue on warfarin.
- For patients who have contraindications for long-term anticoagulation, a left atrial appendage closure procedure could be considered
- Recommendations on the ideal time to initiate anticoagulation after a stroke have not yet delineated. However, expert consensus suggests the following timelines be considered after the event:
  - TIA: 1 day
  - Mild stroke: 3 days
  - Moderate stroke: 6 days
  - Severe stroke: 12 days

(Heidbuchel et al., 2013, as cited in the *2017 Canadian Stroke Best Practice Recommendations: Secondary Prevention of Stroke*)

The importance of medication adherence should be reinforced.

Management of OAC:

Dabigatran:

- Dose of 150 mg twice daily is appropriate for most individuals
- Dose of 110 mg is recommended for patients aged 80 and over or those at risk of bleeding

Rivaroxaban:

- 20 mg OD
- 15 mg OD if Creatinine clearance 30-49

Apixaban:

- 5 mg BID
- 2.5 mg BID in the presence of two or more of the following:
  - Age 80 years and over
  - Weight 60 kg or less
  - Serum Creatinine equal to or greater than 133

Edoxaban

- 60 mg OD
- 30 mg OD if any of the following exist:
  - Creatinine clearance of 30-50 mL/min
  - Body weight of 60 kg or less
  - Accompanying use of potent P-glycoprotein inhibitors (such as erythromycin, cyclosporine, dronedarone, quinidine, or ketoconazole)

Warfarin:

- Initial dosage is 2.5 mg – 10 mg daily
- Maintenance dose dependent on INR
  - Target INR for non-valvular atrial fibrillation is 2.5 (range of 2 – 3)
  - Target INR for atrial fibrillation in presence of heart valve disease, including the presence of a mechanical heart valve, is 3 (range of 2.5 – 3.5)

8.8 Carotid Intervention

Carotid endarterectomy is beneficial for stroke prevention in appropriate patients. It is a surgical procedure that removes atherosclerotic plaque from the proximal internal carotid artery.

Carotid Stenosis may be classified as symptomatic or asymptomatic. Symptomatic carotid disease may result in symptoms of either a TIA and/or stroke. In asymptomatic carotid artery disease, although there may be a significant amount of atherosclerotic build-up, it is not enough to obstruct blood flow that would result in symptoms. (University of Chicago Medical Center, 2014)

One death or severe stroke is prevented in every nine individuals presenting with symptomatic severe (70-99%) carotid stenosis treated with carotid endarterectomy.

Cervicocephalic arterial dissection is a common cause of cerebrovascular disease, especially in younger individuals. It is a hemotoma within the artery wall that can occur either sponantously or due to trauma. It can result in either ischemic or hemorrhagic stroke. The symptoms are ispilateral neck pain with or without ipsilateral headache.

Symptomatic Carotid Stenosis

- Patients with transient ischemic attack or nondisabling stroke and ipsilateral 50 to 99% internal carotid artery stenosis should be evaluated by an individual with stroke expertise (neurosurgeon/vascular surgeon). Selected patients should be offered carotid endarterectomy within two weeks of the incident transient ischemic attack or stroke unless contraindicated.
- Carotid endarterectomy is contraindicated for patients with mild (less than 50%) stenosis.

- Carotid endarterectomy may be recommended for selected patients with moderate (50 to 69%) symptomatic stenosis and should be evaluated by a *Physician* with expertise in stroke management.
- Patients with severe stenosis (70-99%) benefit most from surgery performed within 2 weeks of the event.
- The benefit of endarterectomy depends on the degree of stenosis and the timing of the surgery after the event.
- Carotid endarerectomy is preferable for patients over the age of 70 who are medically safe for surgery.
- Carotid stenting may be considered for patients who are not candidates for surgery due to technical, anatomic or medical reasons.

Asymptomatic Carotid Stenosis

- Carotid endarterectomy may be considered for selected patients who are asymptomatic or remotely symptomatic (over 3 months) with 60-99% carotid stenosis. These patients should be evaluated by a *Physician* with expertise in stroke management.
- Carotid stenting may be considered for patients who are not candidates for surgery due to technical, anatomic or medical reasons.

Intracranial Stenosis

- Intracranial stenting is not recommended for the treatment of recently symptomatic intracranial stenosis 70-99%.
- Dual antiplatelet therapy is suggested using ASA 325mg and clopidogrel (for up to 90 days) as well as aggressive management of all vascular risk factors.
- Medical management decisions should be based upon a person's individual vascular risk factor profile.

Cervicocephalic Artery Dissection

- The diagnosis of cervicocephalic artery dissection is preferably determined by CTA or MRA.
- Carotid or vertebral artery dissection is primarily managed with antithrombotic medications.
- Intracranial dissections are managed on an individualized basis as there are no current recommendations

8.9 Concurrent Cardiac Issues

Patent Foramen Ovale (PFO)

Patent foramen ovale is a small, residual, fetal hole between the two atria in the heart that occurs when it fails to completely close after birth. It is present in approximately 25% of the population. PFO does not cause a stroke but it does provide a route for a potential clot to travel.

Patients with stroke or TIA attributed to PFO should be assessed by a physician with expertise in stroke and cardiovascular conditions.

Recommended management of PFO includes:

- Anticoagulation or antiplatelet therapy, depending on the patient's clinical presentation and individualized risk factor profile
- PFO closure in selected patients meeting a list of inclusion criteria

Aortic Arch Atheroma

The atherosclerosis plaque in the aortic arch is a risk factor for ischemic stroke.

Recommended management includes:

- Maximal management of all appropriate risk factors
- Dual antiplatelet or anticoagulation therapy depending on the individualized risk factor profile and needs of the patient.

Heart Failure, Decreased Ejection Ratio, Thrombus

When a thrombus is identified in the left atrium or left ventricle by a diagnostic imaging modality, anticoagulation therapy is recommended for greater than 3 months.

8.10 Pregnancy and Secondary Prevention of Stroke

Pregnancy is associated with an increased risk of stroke, with the highest risk at the peri-partum and post-partum periods. “Changes in hemodynamics and coagulation” (Swartz et al., 2017, p. 17) underlie this increased stroke risk. The risk factors a patient presents with may be linked to pre-existing risk factors and/or risk factors specific to pregnancy.

Stroke prevention in pregnancy consists of pre-pregnancy consultation, stroke prevention for those at heightened risk during pregnancy, and secondary stroke prevention for those who have had an event during their current pregnancy. The content of this model will focus on last of these three.

When considering how to manage stroke in pregnancy, the CSBPR (2017) instructs practitioners to keep in mind that maternal health is vital to fetal wellbeing. Practitioners are urged to consider how they would manage the treatment of stroke if the patient was not pregnant and how they would manage the pregnancy had she not suffered a stroke.

Blood Pressure Management and Hypertension

Gestational hypertension and preeclampsia are dynamic conditions that frequently require admission, close monitoring, and adjustments to the medical management plan.

The blood pressure target for most women during pregnancy is less than 140/90mmHg.

Blood pressure needs consistent monitoring to identify early rises in blood pressure which could indicate the presence of preeclampsia and to avoid the onset of severe hyperprofusion.

Pharmacological management for pregnant stroke patients can include:

- Labetalol
- Methyldopa
- Long-acting Nifedipine

Angiotension-converting enzyme inhibitors (ACE-I) and Angiotension II Receptor Blockers (ARBs), are avoided due to associated harm to the fetus.

Dyslipidemia and Statins

Management of dyslipidemia focuses on lifestyle management. Physiological changes that occur during pregnancy make accurate interpretation of lipid levels difficult.

Preexisting statin therapy may be interrupted during pregnancy and lactation due to unknown safety for the fetus. The timing for restarting statin after delivery is individualized.

Pre-Existing Diabetes and Gestational Diabetes

Blood glucose targets for women with gestational diabetes are:

- Fasting blood glucose less than 5.3 mmol/L
- 1-hour after eating/meal BG less than 7.8 mmol/L
- 2-hour after eating/meal BG less than 6.7 mmol/L

Management should include:

- Frequent, close monitoring and follow-up by an interprofessional team (including physician specialists, nursing, a nurse educator, a dietitian, etc.)
- Monitoring for complications in the mother and fetus
- Glycemic monitoring
- Monitoring for vascular risk factors
- Medication and lifestyle management throughout pregnancy and during post-partum period

Antiplatet and Anticoagulation

The use of antiplatelets or anticoagulants in pregnancy is individualized. Medical management is guided by:

- Patient history
- Stroke etiology and risk of recurrence
- The size of the stroke and the date of the event
- The mother's stage of pregnancy

Antiplatelets:

ASA is the only antiplatelet deemed safe for pregnancy and lactation.

There is insufficient evidence on the safety of others. However, other antiplatelets may be prescribed if the mother has a clinical condition that indicates it (i.e., clopidogrel) but this is very individudalized.

Anticoagulants:

Low Molecular Weight Heparin (LMWH)

- the preferred anticoagulant during pregnancy and the postpartum period

Warfarin:

- dangerous to fetus development
- may be used in rare instances (i.e., in the presence of a mother with a mechanical heart valve) on a case-by-case basis and in consultation between experts.

Direct/Novel Oral Anticoagulants (Dabigatran, Apixaban, Rivaroxaban, Edoxaban)

- insufficient evidence to support the safe use of these medications
- use discouraged in preference to LMWH

Intravenous, Unfractionated Heparin

- may be used with hospitalized mother instead of LMWH
- use standardized local protocols
- “when using IV unfractionated heparin, a low dose, acute coronary syndrome nomogram, without bolus, is preferred in stroke patients, and would also be preferred in pregnancy” (Swartz, 2017, p. 12)

Specific Conditions that Cause or Increase risk of Stroke

Cardioembolic Condition requiring Anticoagulation (i.e., intracardiac thrombus)

- Anticoagulation is continued throughout pregnancy
- Medication may be adjusted (i.e., to LMWH)

Patent Foramen Ovale

- Closure is not recommended during pregnancy
- Management with low dose ASA, or LMWH if there is an increased venous thrombus risk

Cerebral Venous Sinus Thrombus (CVST)

- A rare cause of stroke with pregnancy as one of the potential pre-disposing conditions
- Use of unfractionated heparin or LMWH for the duration of the pregnancy and the postpartum period.

Cervicocephalic Artery Dissection

- Management is individualized. It may include:
  - Monitoring only (no treatment)
  - Low dose ASA
  - LMWH

Antiphospholipid Antibody Syndrome

- An autoimmune condition that can lead to the formation of blood clots, increase the risk of stroke, and the development of preeclampsia
- Treated with anticoagulation with or without low dose ASA

Cryptogenic Stroke

- Treated with antiplatelets.

8.11 Transient Ischemic Attack (TIA)

Transient ischemic attack (TIA) is defined as a "*transient episode of neurologic dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction*" (Easton et al., 2009).

TIA was originally defined as a sudden onset of a focal neurologic symptom and/or sign lasting less than 24 hours, presumably brought on by a transient decrease in blood supply, which rendered the brain ischemic in the area producing the symptom (Easton et al., 2009). However, the classic definition of TIA, regarding 24 hrs was inadequate for several reasons. Most notably, there is risk of permanent tissue injury (i.e., infarction) even when focal transient neurologic symptoms last less than one hour. Thus, the benign connotation of "TIA" has been replaced by an understanding that even relatively brief ischemia can cause permanent brain injury.

Symptoms of a TIA may include:

The signs of TIA are the same as those for stroke except that they resolve within the short time frame described above.

Some facts:

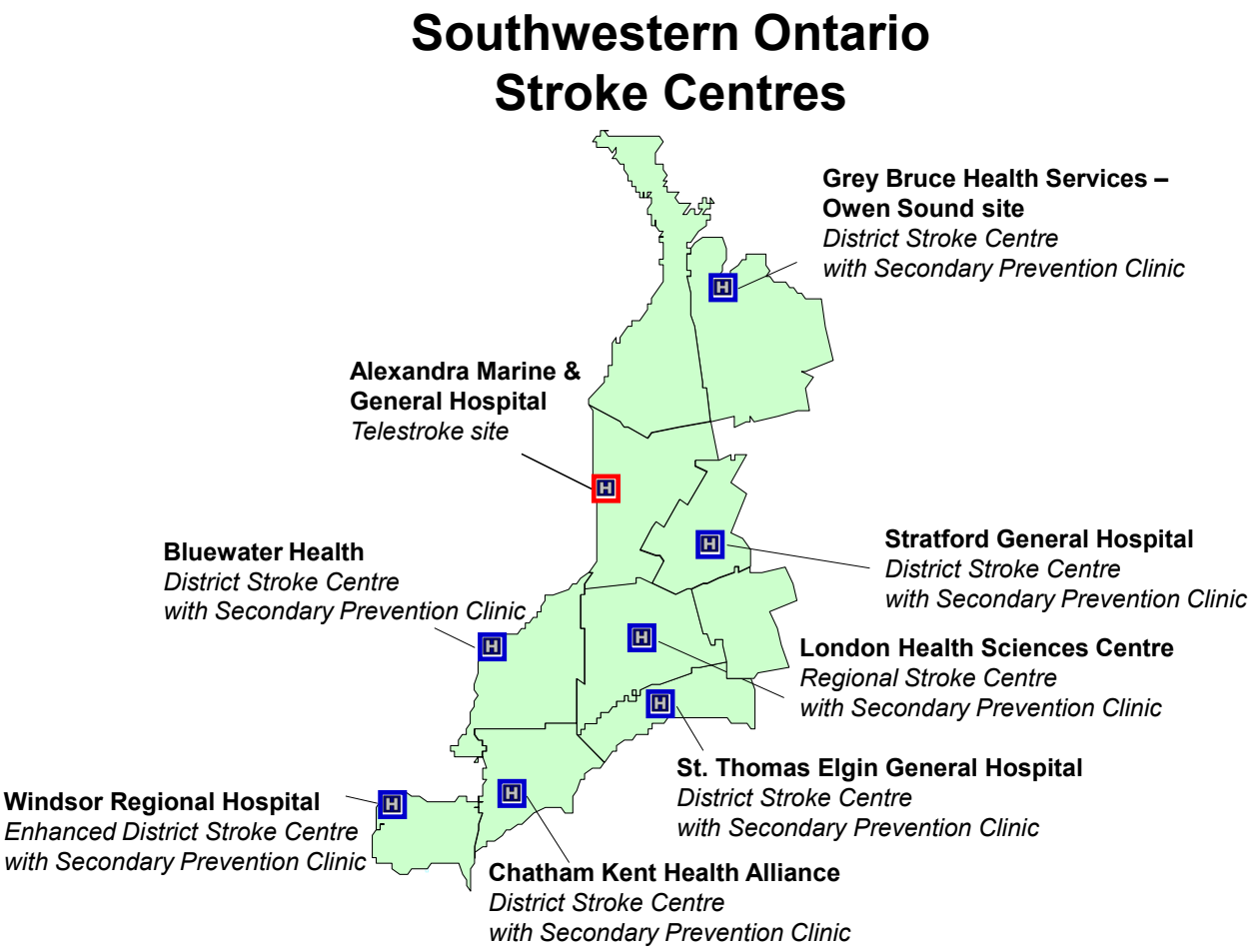
- Recovery is complete
- Is called a serious stroke warning event
- TIA precedes 15% of strokes (Gladstone et al., 2004)
- The 90 day risk of stroke after TIA is 10.5%
- Half of the 90 day risk occurs within the first 2 days (*Johnson et al, 2000*)
- "The risk of stroke 2 and 7 days after TIA is substantial" (Giles & Rothwell, 2007, p. 1071)
  - 31 people out of 1000 people with TIA will have a stroke within 2 days of symptom onset
  - 52 people out of 1000 people with TIA will have a stroke within 7 days of symptom onset

TIA Management

- The management of secondary stroke prevention for TIA is the same as for stroke as laid out in this module. As with stroke, it is dependent on the patient's unique risk factor profile and the etiology of the TIA.
- Rapid specialized assessment and development of a prevention management plan is an important part of TIA care. The urgent nature is to help avoid the onset of stroke within the first 30 days and, especially, within the first 48 hours when the risk of stroke is the highest.

8.12 Role of Secondary Prevention Clinics

- Rapid, specialist consult for patients with suspected TIA and minor, non-disabling stroke
- Avoid an inpatient admission to hospital for patients with TIA and minor, non-disabling stroke
- Facilitate timely investigations to determine etiology
- Initiate appropriate medications
- Support access to timely carotid intervention, when indicated
- Follow-up with appropriate patients who have been discharged from inpatient acute care
- Counsel patients on risk reduction and lifestyle modification
- Refer to specialists



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