Stroke

AHA SCIENTIFIC STATEMENT

Prevention and Treatment of Maternal Stroke in Pregnancy and Postpartum: A Scientific Statement From the American Heart Association

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ABSTRACT: Stroke remains a rare but life-threatening complication of pregnancy, with significant implications for both maternal and fetal health. Current stroke prevention and treatment guidelines offer limited guidance for managing stroke in pregnant and postpartum patients. Despite advances in obstetric and neurological care, the diagnosis and management of pregnancy-associated stroke continue to be challenged by delayed recognition, a lack of tailored clinical guidelines, and persistent disparities in outcomes. This scientific statement represents a multidisciplinary effort to synthesize current knowledge of the risk factors and diverse causes of stroke in pregnancy and to offer consensus-driven suggestions for prevention, acute management, and postpartum recovery. Nearly half of all US pregnancy-associated stroke hospitalizations occur in the setting of hypertensive disorders. Primary stroke prevention strategies include risk factor modification, aggressive hypertension management and prompt treatment of severe hypertension in pregnancy and postpartum, and antithrombotic therapy in some high-risk groups. Secondary stroke prevention strategies in pregnancy depend on the mechanism of the prior stroke. Pregnancy should not delay evidence-based treatments for acute stroke. The use of telemedicine can facilitate early consultation with a vascular neurologist and a maternal-fetal medicine specialist in cases of acute pregnancy-related stroke, helping to guide initial decision-making. Computed tomography, computed tomography angiography, and magnetic resonance imaging without contrast are all safe neuroimaging modalities for rapid evaluation of pregnant patients with acute stroke symptoms. Acute stroke alone is not an indication for immediate delivery, and stabilization of the mother should come first. Vaginal delivery after stroke is preferred when feasible because it avoids the surgical risks and hemodynamic stress associated with cesarean delivery. Survivors of pregnancy-associated stroke face unique challenges such as caring for an infant and breastfeeding and require support from a multidisciplinary rehabilitation team. Continued research, including inclusive clinical trials, is urgently needed to refine stroke risk assessment, to expand treatment options, and to improve maternal outcomes.

Key Words: AHA Scientific Statements ■ postpartum period ■ pregnancy ■ stroke

Stroke is a serious and potentially devastating complication of pregnancy, affecting ≈20 to 40 of every 100 000 pregnancies.[1–5] In some high-risk subgroups such as individuals with preeclampsia the incidence is significantly higher.[6] Stroke during pregnancy or the postpartum period can have catastrophic consequences for both mother and fetus or neonate. Stroke accounts for 4% to 6% of maternal deaths in the United States[7]; however, this may be an underestimation. Fatal strokes associated with hypertensive disorders of pregnancy (HDP), including preeclampsia, may be categorized as HDP-related rather than stroke-related deaths. Although some studies show encouraging functional recovery rates up to 90% after pregnancy-related stroke,[8] others found up to

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20% mortality,[5] and the full impact of stroke on long-term maternal disability remains unclear.

Identified risk factors for pregnancy-associated stroke include HDP, migraine, infections, heart or cerebrovascular disease, and hematologic conditions (eg, thrombophilia, antiphospholipid syndrome, sickle cell disease).[3,9–14] As with broader maternal health disparities, stroke disproportionately affects minority groups, particularly Black patients.[2,15–17]

Pregnancy-associated strokes are heterogeneous in mechanism, including arterial ischemic stroke, cerebral venous thrombosis (CVT), spontaneous intracerebral hemorrhage (ICH), arteriovenous malformation (AVM) rupture, and both aneurysmal and nonaneurysmal subarachnoid hemorrhage (SAH). Unlike the general population, in whom ≈85% of strokes are ischemic, approximately half of pregnancy-associated strokes are hemorrhagic.[4,18] Most occur during the peripartum or postpartum periods, with a median time to postpartum stroke readmission after delivery discharge of ≈8 days.[14] Postpartum stroke readmission rates in the United States remained unchanged between 2013 and 2019.[12] Unfortunately, delays in diagnosis are common.[19]

Current stroke prevention and treatment guidelines offer limited guidance for managing stroke in pregnant and postpartum patients. The gap is due largely to the exclusion of pregnant and lactating individuals from all major stroke trials. Nonetheless, over the past decade, a growing body of observational research has emerged. Despite limitations, these data provide a foundation for clinical decision-making and patient counseling on prevention, treatment, and recovery.

Given the complexity of evaluating and treating pregnancy-associated stroke, optimal care requires a multidisciplinary approach. To address this need, we convened a panel of clinical experts in vascular neurology, maternal-fetal medicine, emergency medicine, obstetric anesthesiology, cardio-obstetrics, vascular neurosurgery, and stroke nursing. This scientific statement reviews current evidence on the epidemiology, pathophysiology, prevention, and treatment of maternal stroke and offers best practice suggestions while acknowledging the limitations of the available data.

PHYSIOLOGY AND PATHOPHYSIOLOGY OF PREGNANCY

Physiology of Pregnancy

Pregnancy induces a range of physiological adaptations that, although necessary to support fetal development, can increase the risk of stroke. Although advanced maternal age (defined as ≥35 years of age) is a recognized risk factor, even young pregnant and postpartum individuals face a higher risk of stroke compared with their nonpregnant counterparts.[20]

The physiological hypercoagulable state of pregnancy, characterized by increased levels of factors VII, VIII, and X; von Willebrand factor; and fibrinogen and decreased levels of protein S, contributes to stroke risk.[21] The concentrations of several antifibrinolytic agents such as plasminogen activator inhibitors 1 and 2 are increased.[22] These changes, when combined with pregnancy-related dehydration (eg, from hyperemesis gravidarum), venous stasis from uterine compression of the pelvic veins, and potential vascular trauma during delivery, heighten the risk of thromboembolic and thrombotic events, including arterial ischemic stroke, paradoxical embolism, and CVT.

Cardiovascular and immunological adaptations also play a role.[23] Pregnancy results in decreased systemic vascular resistance and increased plasma volume, stroke volume, and cardiac output, sometimes up to 45%.[24] Arterial pressures nadir during the second trimester and then typically increase to prepregnancy values postpartum. Pregnancy also induces immune system modulation, with alternating proinflammatory and anti-inflammatory states across trimesters: an inflammatory phase in the first trimester that promotes implantation, a second-trimester anti-inflammatory phase that permits fetal growth and development, and a proinflammatory phase at delivery.[25] Patients with underlying autoimmune conditions such as systemic lupus erythematosus have inherent immunological disruptions and face a 2- to 3-fold higher risk of stroke, particularly at younger ages,[26] although trends in outcomes for these women are improving.[27] They also face other pregnancy complications, including preterm birth, fetal growth restriction, and HDP.[28,29]

Infections during pregnancy, particularly genitourinary infections and sepsis, have been linked to increased stroke risk. One case-control study found that infection on admission for delivery doubled the odds of stroke[9]; the odds of stroke were 2 to 3 times higher for genitourinary infections (including chorioamnionitis) and 10-fold higher for sepsis. A subsequent retrospective cohort study found infection to be associated with readmission for ischemic but not hemorrhagic stroke, even in the absence of other risk factors.[11]

Hypertensive Disorders of Pregnancy

HDP, including gestational hypertension, preeclampsia/eclampsia, and chronic hypertension with superimposed preeclampsia, affect ≈10% of pregnancies and increase stroke risk by up to 5-fold (Table 1).[29] Preeclampsia is associated with sympathetic nervous system overactivity and higher risk of both hemorrhagic and ischemic stroke.

Nearly half of all pregnancy-associated stroke hospitalizations in the United States occur in the setting of HDP.[31] These strokes are often more severe with higher rates of complications compared with strokes not associated with HDP. Concurrent infections, coagulopathies, and underlying prothrombic conditions increase stroke risk in patients with preeclampsia. In addition, HDP are associated with an increased risk of stroke later in life.[32,33]

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Table 1. HDP: Definitions[30]

Disorder	Blood pressure	Other features/criteria
Preeclampsia	≥140/90 mm Hg on at least 2 occasions	1. Proteinuria (>300 mg/24 h), protein-creatinine ratio >0.3 g/g creatinine or ≥1 dipstick or 2. Any of the following severe symptoms: SBP ≥160 mm Hg or DBP ≥ 110 mm Hg Platelets <100 000/μL Elevated liver transaminase (2-fold) Serum creatinine >1.1 mg/dl Pulmonary edema New cerebral or visual disturbance
Eclampsia	≥140/90 mm Hg on at least 2 occasions	Seizures with or without any of the above
HELLP	≥140/90 mm Hg on at least 2 occasions	Presence of all the below with or without other features of preeclampsia: 1. Hemolysis: lactate dehydrogenase ≥600 IU/L or on peripheral smear 2. Aspartate and alanine aminotransferases elevated ≥2 times normal 3. Low platelets: <100 000×10⁹/L
Preeclampsia superimposed on chronic hypertension	Worsening BPs >140/90 mm Hg	Same as preeclampsia
Gestational hypertension	SBP ≥140 mm Hg or DBP ≥90 mm Hg on at least 2 occasions	Absence of proteinuria or other severe features above

BP indicates blood pressure; DBP, diastolic blood pressure; HDP, hypertensive disorders of pregnancy; HELLP, hemolysis, elevated liver enzymes and low platelets; and SBP, systolic blood pressure.

Chronic Medical Comorbidities

As in the nonpregnant population, diabetes and obesity are associated with elevated stroke risk.[34] Active migraine, particularly with aura, is also associated with elevated stroke risk during pregnancy (odds ratio range, 7.9–30.7).[34,35]

Social Determinants of Health

A 2020 meta-analysis noted that Black pregnant individuals experience disproportionately high rates of stroke, twice the risk of their White counterparts, even after adjustment for socioeconomic factors.[17] Similar racial disparities persist in stroke incidence, treatment, and outcomes in nonpregnant populations, likely a result of the impact of social determinants of health (ie, the conditions in which people are born, live, learn, work, and play). A full discussion of the impact of social determinants of health on racial disparities in stroke is beyond the scope of this scientific statement, but this topic has been covered extensively in other statements and guidelines[36–39]; similar principles apply to stroke disparities in pregnant and postpartum individuals.

MECHANISMS OF MATERNAL STROKE

Stroke in pregnancy or postpartum may occur through multiple mechanisms, as detailed here (Figure 1).

Hemorrhagic Stroke (ICH and SAH)

Hemorrhagic stroke types, including ICH and SAH, are more common in pregnant individuals than in age-matched nonpregnant women, with an adjusted incidence risk ratio of 1.4 (95% CI, 1.2–1.8).[4] The risk is highest during the peripartum and postpartum periods, largely in association with HDP. Effective blood pressure control around the time of delivery is essential; mortality rate for pregnancy-associated hemorrhagic stroke can reach 20%.[40,41]

Cerebrovascular malformations, including aneurysms, AVMs, and cavernous malformations, are known causes of hemorrhagic strokes. Although data on pregnancy-related rupture risk are mixed, hypertension is a significant contributor to bleeding. Aneurysmal SAH is associated with maternal mortality rates up to 50% and fetal mortality rates of ≈17%.[42]

Reversible cerebral vasoconstriction syndrome and posterior reversible encephalopathy syndrome are also implicated in pregnancy-associated ICH and SAH. Both conditions involve disruption to cerebral autoregulation. Preeclampsia and eclampsia, the most severe forms of HDP, are highly associated with both of these syndromes.

Ischemic Stroke

Ischemic strokes account for a significant proportion of pregnancy-associated strokes, with most classified as cryptogenic (57%). Identifiable causes include cervical artery dissection (11%), cardioembolism (13%), and prothrombotic disorders (6%).[13] Cervical artery dissections are more common in the postpartum period, possibly because of the hormonal vascular changes that affect vascular integrity. The risk

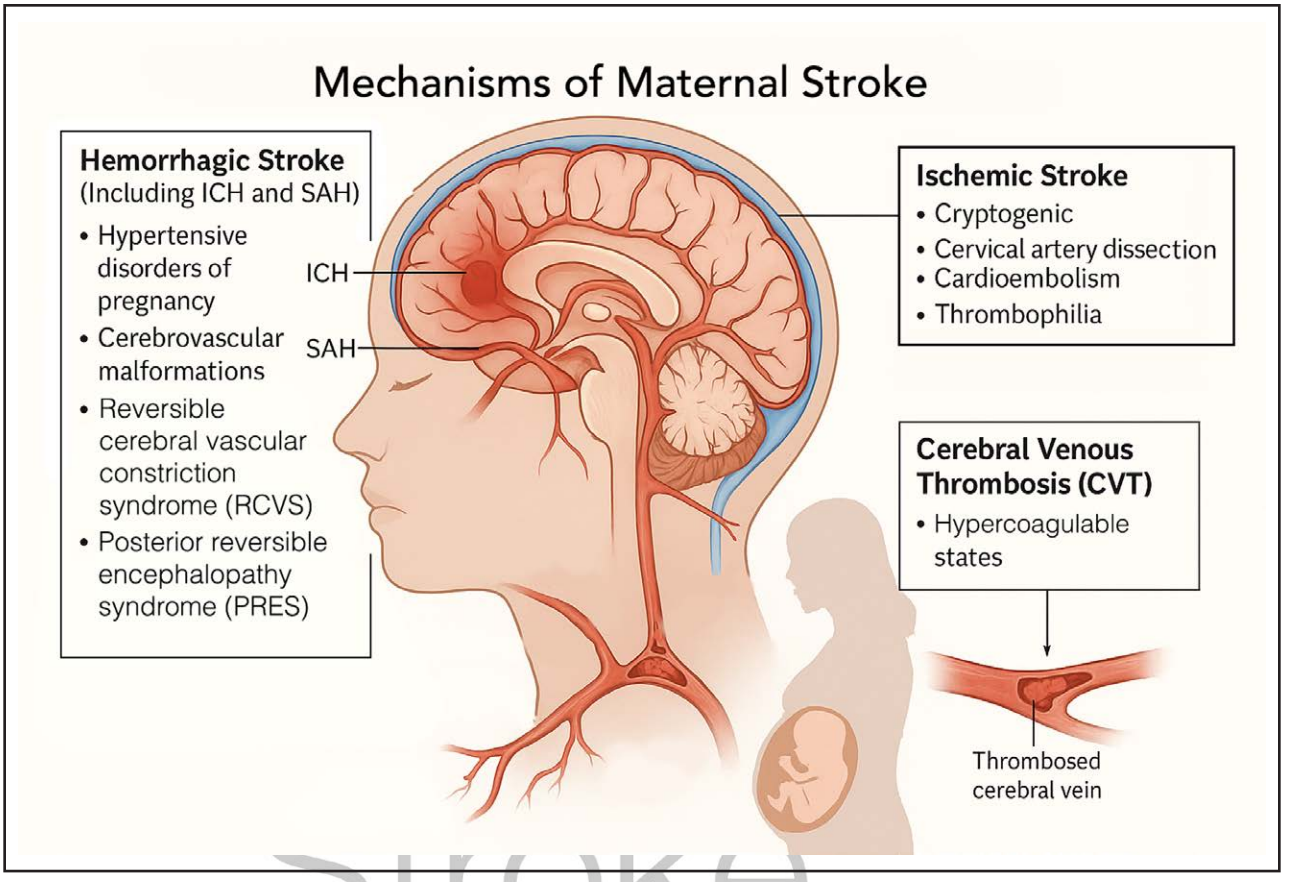

Figure 1. Mechanisms of maternal stroke.
ICH indicates intracerebral hemorrhage; and SAH, subarachnoid hemorrhage.

of dissection is estimated to be >5 times higher in pregnant and postpartum women than in the general population.[43]

Cardioembolic stroke may occur in patients with underlying cardiac conditions or peripartum cardiomyopathy (PPCM; see the primary prevention section).[44] In patients with structural cardiac abnormalities such as unrepaired atrial septal defects, physiological hemodynamic changes of pregnancy can lead to transient shunt reversal, resulting in increased arrhythmias (4%–5%) or paradoxical emboli (2%–5%).[45] As in nonpregnant young adults, a patent foramen ovale, present in up to 73% of young patients with cryptogenic stroke and without vascular risk factors,[46] can serve as a conduit for paradoxical embolism, particularly in the setting of pregnancy-related hypercoagulability.[47]

Cerebral Venous Thrombosis

Compared with nonpregnant women, the risk of pregnancy-associated CVT is increased >8-fold (incidence risk ratio, 8.1 [95% CI, 6.5–10.1]). CVT is most commonly diagnosed postpartum (80% of cases).[4] One study reported a 19-fold increase in risk during the first 6 weeks postpartum.[13] Pregnancy-induced hypercoagulability is the key driver, and risk is compounded in those with acquired or inherited thrombophilias.

PRIMARY PREVENTION OF PREGNANCY-RELATED STROKE

Prevention of pregnancy-related stroke begins before conception, with optimization of prepregnancy health.[48] General primary stroke prevention strategies should be followed for all pregnancy-capable individuals, in line with the 2024 American Heart Association/American Stroke Association Guideline for the Primary Prevention of Stroke, using the Life's Essential 8 framework. This includes screening for modifiable behaviors, medical conditions, and social determinants of health such as food insecurity or lack of transportation that may contribute to stroke risk.[36] However, patients at higher risk of stroke may require targeted primary prevention strategies.

Hypertensive Disorders

Hypertensive emergencies in pregnancy and the postpartum period require prompt recognition and treatment to prevent severe maternal morbidity and mortality from

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stroke. Although some strokes cannot be predicted or prevented, the majority of fatal maternal strokes (usually due to ICH) have been deemed preventable with earlier and more aggressive blood pressure control. In contrast to nonpregnant adults, in whom hypertension is defined as systolic blood pressure ≥130 mm Hg or diastolic blood pressure ≥80 mm Hg,[49] the American College of Obstetricians and Gynecologists defines hypertension as systolic blood pressure ≥140 mm Hg or diastolic blood pressure ≥90 mm Hg in pregnant and postpartum individuals. Severe hypertension in pregnancy is defined as persistent systolic blood pressure ≥160 mm Hg or diastolic blood pressure ≥110 mm Hg, confirmed within 15 minutes.[30] Severe hypertension in pregnancy or postpartum is a medical emergency and, if left untreated, significantly increases the risk of ICH.[36] The use of algorithms to manage acute hypertension in pregnancy and postpartum is suggested such as those published by American College of Obstetricians and Gynecologists as part of their Identifying and Managing Obstetric Emergencies in Nonobstetric Settings initiative.[50]

The primary goal of antihypertensive therapy during pregnancy and in the early postpartum period (the time of greatest stroke risk) is to prevent the complications of severe hypertension and preeclampsia while balancing maternal and fetal risks and benefits. Evidence supports treating chronic hypertension in pregnancy before it reaches severe levels, targeting a goal blood pressure <140/90 mm Hg.[51–55] For individuals with gestational hypertension and preeclampsia, American College of Obstetricians and Gynecologists and Society for Maternal-Fetal Medicine guidelines currently do not recommend treatment of mild range hypertension, whereas some international societies extrapolate findings from the CHAP trial (Chronic Hypertension and Pregnancy) to recommend a threshold for treatment for all HDP.[56–58]

Postpartum hypertension management remains less defined in guidelines because of a lack of data for this patient population. Obstetricians often tolerate higher postpartum blood pressures, based on thresholds defined for pregnancy (<140/90 mm Hg), whereas internists may adopt lower targets (eg, <130/80 mm Hg), similar to the goal blood pressure in nonpregnant adults, given the absence of concern for uteroplacental hypoperfusion. Observational data suggest a correlation between tighter blood pressure control in the early postpartum period and decreased rates of postpartum emergency department visits and readmissions.[59,60] Optimal blood pressure targets in the early postpartum period are not well defined; this is an area of active investigation, with clinical trials underway or planned.[61–63] Multidisciplinary care incorporating home blood pressure monitoring in the postpartum period is a promising strategy for the prevention of hypertension-associated postpartum maternal morbidity in individuals with HDP.[62]

Preeclampsia and eclampsia can occur before, during, or after delivery. Magnesium sulfate for seizure prevention and antihypertensive medications to lower stroke risk remain the cornerstones of management. Daily low-dose aspirin has been shown in meta-analysis to significantly reduce the risk of preeclampsia in high-risk individuals compared with placebo (pooled risk ratio 0.85 [95% CI, 0.75–0.95]).[64]

Cardiac Conditions

Simple congenital heart diseases, including patent foramen ovale and atrial septal defect, and complex congenital heart disease are all associated with increased stroke risk of differing magnitudes.[36,65] In the absence of data to guide primary stroke prevention in pregnant patients across the spectrum of congenital heart disease, the use and choice of antiplatelet and antithrombotic agents should be guided by a cardio-obstetrics collaborative team. Patients with an indication for therapeutic anticoagulation (eg, mechanical prosthetic valve) should be followed up carefully with medication adjustments to avoid teratogenicity and excessive bleeding risks around the time of delivery (Table 2).[62,64,66-71] In patients with congenital heart disease with known right-to-left shunt, the use of filtered intravenous lines is a reasonable precaution to reduce the risk of paradoxical air embolism.[47]

Peripartum Cardiomyopathy

PPCM, a condition characterized by new-onset reduced left ventricular function in late pregnancy or the first 5 months postpartum, is associated with increased stroke risk.[72] A study using New York State administrative data found that stroke occurred in 140 per 10 000 deliveries in women with PPCM compared with 19 per 10 000 deliveries in those without PPCM. Stroke risk was highest at the time of PPCM diagnosis but remained elevated throughout the first postpartum year.[44] A prospective PPCM registry from 51 countries also found that 2.5% of women with PPCM had a stroke within 1 year of delivery, of which 60% were ischemic and 40% were hemorrhagic.[73] Stroke is seen more frequently in patients with significantly reduced left ventricular ejection fraction (<35%) or left ventricular thrombus.[74] In the absence of a definitive indication for therapeutic anticoagulation, it can be prophylactically considered in patients at heightened risk, although data for optimal patient selection and duration of therapy for stroke prevention are lacking.[75]

Hematologic Disorders

Underlying hematologic disorders, including sickle cell disease and inherited or acquired thrombophilias, can increase stroke vulnerability. Whereas inherited thrombophilias such as factor V Leiden and prothrombin gene mutations have not been consistently linked to an increased ischemic stroke risk in older adults,[76,77]

Table 2. Primary and Secondary Stroke Prevention Medication Safety in Pregnancy and Lactation

Antihypertensive medications in pregnant individuals			
Medication	**Starting dose**	**Maximum daily dose**	**Titration interval**
First-line agents			
Labetalol	200 mg 2–3 times a day	2400 mg/d	Every 2–3 d
Nifedipine XL	30 mg daily	120 mg/d or 60 mg twice a day	Every 5–7 d
Alternative agents			
Alpha methyldopa	250 mg 2–3 times a day	3000 mg	Every 2–3 d
Clonidine	0.1 mg by mouth twice daily or 0.1-mg patch weekly	2.4 mg or two 0.3-mg patches/24 h	Every 7 d
Hydrochlorothiazide	12.5–25 mg daily	50 mg	Every 3–5 d
Hydralazine*	10 mg 4 times daily	200 mg	Every 2–3 d
Angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, direct renin inhibitors, and mineralocorticoid receptor antagonists are contraindicated in pregnancy because of the potential for fetal harm.			

Postpartum treatment of hypertension[62]				
Medication	**Starting dose**	**Maximum dose**	**Titration interval**	**Lactation safety***
First-line agents				
Nifedipine XL	30 mg daily	120 mg/d or 60 mg twice daily	Every 5–7 d	Safe RID 2.3%–3.4%
Enalapril	5 mg daily	40 mg/d or 20 mg twice daily	Every 5–7 d	Safe RID 1.1%
Amlodipine	5 mg daily	10 mg/d	Every 5–7 d	Safe RID 1.7%–4.3%
Labetalol	200 mg 2–3 times a day	2400 mg/d	Every 2–3 d	Safe RID 3.6%
Alternative agents				
Hydrochlorothiazide	12.5 mg daily	50 mg/d	Every 3–5 d	Safe RID 0.6%–1.2%; may decrease breastmilk production (dose >25 mg/d)
Furosemide	10 mg daily	160 mg/d (2- or 3-times-a-day dosing)	Every 3–5 d	Safe RID may decrease breastmilk production (dose >20 mg/d)
Hydralazine	10 mg 4 times daily	200 mg/d	Every 2–3 d	Safe RID 0.77%–3%
Spironolactone	12.5 mg daily	NA	Every 14–30 d	Safe RID 2%–4.3%
Verapamil	80 mg daily	360 mg/d	Every 5–7 d	Safe RID <1%
Carvedilol	6.25 mg twice daily	25 mg twice daily or 50 mg twice daily if weight >100 kg	Every 2–3 d	Limited safety data, likely low risk
Metoprolol tartrate	12.5 mg twice daily	200 mg twice daily	Every 2–3 d	Limited safety data, likely low risk
Bisoprolol	2.5 mg daily	20 mg/d	Every 5–7 d	Limited safety data
Chlorthalidone	12.5 mg daily	100 mg/d	Every 7–14 d	RID 1.9%–18.1%; present in breastmilk, may decrease breastmilk production
Eplerenone	25 mg daily	NA	Every 14–30 d	RID 0.01%–3.39%; limited safety data
Lisinopril	2.5 mg daily	40 mg/d	Every 5–7 d	Limited safety data
Losartan	25 mg daily	100 mg/d	Every 5–7 d	Limited safety data
Valsartan	20 mg daily	320 mg/d	Every 5–7 d	Limited safety data
Clonidine	0.1 mg twice daily or 0.1-mg patch weekly	2.4 mg by mouth daily or two 0.3-mg patches/24 h	Every 7 d	RID 0.9%–7.1%; limited safety data; present in breastmilk and likely negatively affects lactation

Antithrombotic agents in pregnant and lactating individuals[64,66-69]			
Medication	**Dose**	**Pregnancy safety**	**Lactation safety**
Aspirin	<100 mg daily	Safe; first choice antiplatelet agent. No need to discontinue before regional anesthesia.	May be used for cardiovascular indications; subclinical amounts in breastmilk
Clopidogrel	75 mg daily	Use for shortest duration necessary. Animal studies show no adverse effects; limited human data. Stop 5–7 d before regional anesthesia.† May be resumed immediately after (no loading dose) unless high bleeding risk.	Assess risk/benefit; low risk of infant harm based on limited human data and drug properties

(*Continued*)

Table 2. Continued

Antithrombotic agents in pregnant and lactating individuals (continued)[64,66-69]			
Medication	**Dose**	**Pregnancy safety**	**Lactation safety**
Prasugrel	5–10 mg daily depending on weight	Minimal data. Stop 7–10 d before regional anesthesia.† May be resumed immediately after (no loading dose) unless high bleeding risk. Neuraxial should not be maintained with prasugrel because of the rapid onset.	No published information is available on the use of prasugrel during breastfeeding. Until more data become available, prasugrel should be used with caution during breastfeeding, especially while a newborn or preterm infant is nursing.
Cangrelor	Intravenous, weight based	Minimal data. Risk of serious bleeding in the presence of residual cangrelor effect is unknown. Avoid needle placement for 3 h after discontinuation of cangrelor. Remove neuraxial catheters before reinstitution of cangrelor therapy postoperatively. First postoperative dose of cangrelor be administered 8 h after neuraxial catheter removal.	No data available
Ticagrelor	90 mg twice daily	Minimal data. ticagrelor does cross placenta. Stop 5 d before regional anesthesia. Neuraxial catheters should not be maintained with ticagrelor because of the rapid onset. May be resumed immediately after (no loading dose) unless high bleeding risk.	No published information is available on the use of ticagrelor during breastfeeding. Because ticagrelor and its active metabolite are >99% bound to plasma proteins, the amount in milk is likely to be low.
Warfarin	<5 mg in pregnancy; variable in lactation	Teratogenic in first trimester; may be considered after first trimester for select patients (mechanical valve). Stop 5 d before planned procedures. Ensure INR is in normal range of local laboratory before neuraxial anesthesia. Check INR before needle placement if first dose given >24 h earlier or if second dose of oral anticoagulant has been administered. In patients receiving low-dose warfarin therapy during epidural analgesia, monitor INR daily. Remove neuraxial catheters when INR <1.5.	Safe; unlikely excreted into breastmilk
LMWH	Therapeutic: weight based (enoxaparin 1 mg/kg every 12 h, enoxaparin 1.5 mg/kg daily, dalteparin 120 IU/kg every 12 h, dalteparin 200 IU/kg daily Prophylactic: low dose (enoxaparin 40 mg/d, enoxaparin 30 mg every 12 h, dalteparin 5000 IU daily) preferable to weight based for thromboprophylaxis in pregnancy[65]	Safe; first-choice anticoagulant. Regional anesthesia needle placement should occur at least 12 h after low-dose LMWH. Consider checking aXa activity level if <12 h. Suggested acceptable aXa: ≤0.1 IU/mL. High (therapeutic)-dose LMWH: wait at least 24 h before needle/catheter placement. Intermediate (weight-based dosing) should follow recommendations for high dose for neuraxial anesthesia.	Safe; minimally excreted into breastmilk and limited oral bioavailability to infant
UFH	Preoperative low-dose UFH for thromboprophylaxis (5000 U 2 times per day or 3 times per day)	Safe; for neuraxial anesthesia, wait 4-6 h after low dose before needle/catheter† placement	Safe; does not pass into breastmilk
Dabigatran	NA	Insufficient data	Insufficient data
Rivaroxaban, apixaban	NA	Insufficient data	Insufficient data

(*Continued*)

Table 2. Continued

Antithrombotic agents in pregnant and lactating individuals (continued)[64,66-69]			
Medication	**Dose**	**Pregnancy safety**	**Lactation safety**
Fondaparinux	Variable, weight based (subcutaneous injection)	Crosses placenta in small amounts; limited data in pregnancy. Hold at least 70 h in patients with normal renal function. Test aXa activity calibrated to fondaparinux before placing neuraxial anesthesia if not held for recommended time (aXa ≤0.1 IU/mL).	Considered to be acceptable to use during breastfeeding
Other stroke prevention medications			
Statins	Varies by specific medication	Assess risk/benefit. No evidence of teratogenicity or increased major birth defects.[70,71]	Not recommended due to concern about disruption of infant lipid metabolism

aXa indicates anti-Xa; INR, international normalized ratio; LMWH, low-molecular-weight heparin; NA, not applicable; RID, relative infant dose; and UFH, unfractionated heparin.

All time intervals for holding antithrombotic medications assume normal renal function and weight >40 kg unless otherwise specified.

*RID levels <10% are considered safe.

†In circumstances involving select high-risk parturients receiving thromboprophylaxis and requiring urgent interventions for maternal or fetal indications, the risk of general anesthesia may be greater than for neuraxial anesthesia, and exceptions/modifications of these recommendations may be appropriate.

they are strongly associated with a higher risk of both arterial and venous stroke in young adults,[24] including pregnant patients.[18,78] Inherited thrombophilias and antiphospholipid syndrome can increase the risk of pregnancy-associated ischemic stroke by as much as 16-fold compared with those without these conditions.[78] Aspirin is recommended for primary prevention of stroke in patients with antiphospholipid syndrome, regardless of pregnancy status, depending on the individual risk profile of the patient. In some cases, prophylactic anticoagulation in pregnancy and postpartum may be added in consultation with a hematologist[79,80]; however, no randomized trials have tested this strategy for stroke prevention in pregnancy.

Aneurysms and AVMs

Aneurysms and AVMs can cause SAH and ICH in young women during pregnancy. However, most pregnancy-related SAHs are nonaneurysmal. There is no definitive evidence that the risk of aneurysm rupture increases during pregnancy or the postpartum period.[81,82]

The risk of AVM hemorrhage in pregnancy remains controversial. Some studies suggest no difference[83] compared with nonpregnant women, whereas others suggest a 3-fold increased risk.[84,85] A Swedish hospital-based cohort found that >80% of women who experienced AVM rupture during pregnancy had previously completed at least 1 uneventful pregnancy.[84] Most hemorrhages occurred in the second or third trimester, suggesting that risk is unrelated to delivery. This pattern was also seen in a large population-based cohort from Finland.[83] No data suggest that elective cesarean delivery decreases the risk of AVM or aneurysm rupture. Given the potential severity of these events and variability in risk, care of patients with aneurysms or AVMs during pregnancy should involve a multidisciplinary team to guide individualized prevention and management strategies, as well as recommendations on delivery mode.

Moyamoya Disease

Pregnancy poses specific risks for women with moyamoya disease, a progressive steno-occlusive cerebrovascular disorder associated with both hemorrhagic and ischemic stroke. Women diagnosed with moyamoya disease before pregnancy who underwent revascularization were significantly less likely to experience cerebrovascular events during pregnancy compared with those who did not undergo revascularization.[86,87] In contrast, patients who are first diagnosed with moyamoya disease during pregnancy often present with stroke: two-thirds experience hemorrhagic events, and one-third had ischemic events. In women without prior cerebrovascular symptoms, the mode of delivery (vaginal versus cesarean) does not appear to significantly affect maternal or fetal outcomes.[87] To reduce the risk of ischemic events, it is essential to avoid dehydration and hypotension during the antepartum, intrapartum, and postpartum periods. Low-dose aspirin throughout the pregnancy may offer additional protection against ischemic complications.

Other Arteriopathies

Other arteriopathies that may increase stroke risk include fibromuscular dysplasia, collagen vascular diseases (eg, vascular Ehlers-Danlos syndrome, Marfan syndrome), and inflammatory arteritides (eg, Takayasu arteritis).[88–92] These patients have higher incidence of HDP and other adverse pregnancy outcomes, but the incidence of pregnancy-related stroke in patients with these conditions without a stroke history is unknown. Management

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should be individualized and focused on prevention and early treatment of hypertension. No data suggest that cesarean delivery prevents stroke in patients with arteriopathies. Assisted second-stage delivery (forceps or vacuum assisted) is another reasonable option to consider in patients felt to be at high risk for Valsalva.

SECONDARY STROKE PREVENTION IN PREGNANCY

Secondary prevention focuses on reducing recurrent stroke risk in women with a history of cerebrovascular events, whether pregnancy related or not. In a French cohort of 1204 pregnancy-related strokes, only 2 women experienced recurrent stroke in subsequent pregnancies, both of which were postpartum hemorrhagic strokes, despite 16% of women having another pregnancy.[93] Other studies suggest increased risks of miscarriage and fetal death, especially in women with prior ischemic stroke or CVT. Nonetheless, the absolute risk of recurrent stroke during pregnancy remains low.[94,95]

Secondary prevention strategies are guided by stroke mechanism. Low-dose aspirin is considered safe for most pregnant patients with prior ischemic stroke or TIA. For high-risk situations such as patients with antiphospholipid syndrome, mechanical valves, or prior cardioembolic stroke, therapeutic anticoagulation with low-molecular-weight heparin during pregnancy is typically recommended. In patients with cryptogenic stroke and patent foramen ovale, closure may be considered before a future pregnancy when the Risk of Paradoxical Embolism score, a tool used to estimate the probability that the stroke is related to a patent foramen ovale, is ≥7.[96]

Preconception counseling includes stroke risk review, evaluation of medication safety (Table 2), and lifestyle counseling, including smoking cessation and weight management. Close monitoring of blood pressure, especially in the peripartum and early postpartum periods, is essential.

TREATMENT OF ACUTE STROKE IN PREGNANCY AND POSTPARTUM

Presenting Signs and Symptoms and Members of Maternal Stroke Team

Prompt recognition of stroke symptoms is essential to minimize morbidity and to initiate timely treatment. Pregnant and postpartum individuals presenting with new neurological deficits or severe headache, especially in the context of elevated blood pressures, require immediate evaluation for possible stroke.[97] The presence of HDP significantly increases stroke risk and should heighten clinical suspicion.

History, blood pressure assessment, and neurological examination are necessary to evaluate for ischemic stroke, ICH, CVT, SAH, reversible cerebral vasoconstriction syndrome, or posterior reversible encephalopathy syndrome. Symptoms of ischemic stroke or ICH may be focal or localize to a particular area of the brain, but some stroke types may be less focal. Mechanisms that may disproportionately contribute to ischemic strokes in pregnant or postpartum women include cervical artery dissection, which often presents with headache and neck pain. Reversible cerebral vasoconstriction syndrome typically presents with thunderclap headaches and segmental vasoconstriction, whereas posterior reversible encephalopathy syndrome is marked by vasogenic edema, progressive headaches, and seizures. Both may result in either hemorrhagic or ischemic stroke. Signs or symptoms of central venous thrombosis may also be focal, but often include progressive, positional headaches that are either different from prior, more severe, or associated with neurologic deficits.

Pregnant or postpartum patients with stroke may present to emergency departments, labor and delivery units, or outpatient settings such as urgent care clinics. We suggest that all clinical staff who care for pregnant individuals, including obstetricians, family medicine practitioners, nurses, and advanced practice clinicians, be trained to recognize stroke symptoms and activate a stroke alert. In the case of pregnant or postpartum patients, we suggest augmentation of current stroke systems of care to facilitate mobilization of a multidisciplinary team (aka, maternal stroke team) that includes vascular neurology, emergency medicine, maternal-fetal medicine or obstetrics, obstetric anesthesiology, and, when appropriate, neonatology.

Given the complexity of these cases, evaluation by a vascular neurologist is suggested either in person or, more commonly, through telestroke consultation to complete the neurological evaluation and to guide acute stroke treatment. In lower-resource settings where telestroke consultation is not available, telephone consultation with a vascular neurologist is recommended to guide acute decision-making, and transfer to a higher level of care may be necessary. To avoid delays in multidisciplinary care, an obstetrician or maternal-fetal medicine specialist should also be consulted by telemedicine or telephone to help guide initial hyperacute management. Other critical members of the stroke team are pharmacists and stroke-specialized nurses.[98]

Neuroimaging

In the setting of acute stroke, neuroimaging should never be withheld because of pregnancy. Both computed tomography (with or without contrast) and magnetic resonance imaging (without contrast) are considered safe during pregnancy or lactation, with use of contrast when

benefits outweigh risks (Table 3). Current guidelines do not recommend lead shielding of the gravid uterus for computed tomography scans because shielding may interfere with computed tomography machine sensors that adjust the amount of radiation used according to the body part being imaged and could result in more radiation exposure to the fetus or may reduce the quality of the examination.[101]

Thrombolysis and Mechanical Thrombectomy

Pregnant and breastfeeding women have historically been excluded from clinical trials of thrombolysis and mechanical thrombectomy, leaving clinicians to rely on case series, registries, and expert opinions. Safety data support the use of hyperacute reperfusion therapies in the peripartum period. A registry of 40 pregnant or postpartum women treated with intravenous thrombolysis or thrombectomy showed no in-hospital deaths, with outcomes comparable to those in nonpregnant women, although the rate of symptomatic ICH was slightly higher.[109] A National Inpatient Sample–based study similarly showed no in-hospital deaths and overall better outcomes in pregnant and postpartum patients with thrombectomy compared with nonpregnant patients.[110] Pregnancy should not delay evidence-based treatments for acute stroke. US–based guidelines support the use of intravenous alteplase during pregnancy when the potential benefits (eg, prevention of long-term disability) outweigh the risks (eg, uterine bleeding). The risks and benefits of systemic thrombolysis must be carefully weighed when surgery such as cesarean delivery is anticipated or planned. Decisions during the early postpartum period should be individualized, especially in patients with recent cesarean delivery or neuraxial anesthesia due to bleeding risk.[97] Alteplase and tenecteplase do not cross the placenta, and case reports suggest good fetal outcomes after treatment. However, data on tenecteplase use in pregnancy remain limited.

Current guidelines recommend mechanical thrombectomy[111] for select large-vessel occlusions, which may be used alone or in combination with thrombolytics.[97,112] For pregnant patients, a transradial approach is preferred for endovascular procedures whenever possible. Because hemodynamic alterations are frequently encountered in patients with acute stroke, continuous fetal monitoring should be strongly considered during neurosurgical or endovascular procedures in the third trimester, with preparation for urgent delivery should a maternal or fetal indication arise.

ICH and SAH

Management of hemorrhagic stroke in pregnancy requires a multidisciplinary approach. When brain AVMs or aneurysms are present, individualized delivery planning and neurosurgical consultation are critical. Acute ICH may require hematoma evacuation through craniotomy or minimally invasive surgery. SAH-associated hydrocephalus often necessitates ventriculostomy. The ruptured aneurysm can be secured by craniotomy clipping of the aneurysm or coil embolization with endovascular technique. If it is suitable, coil embolization is less stressful for the mother and fetus. Transradial approaches may reduce fetal radiation exposure. In AVM-related hemorrhage, embolization or surgical obliteration may be necessary during the second or third trimester or postponed until after delivery, depending on the lesion severity and maternal stability.

DELIVERY CONSIDERATIONS AFTER STROKE

Management of delivery in patients with a recent stroke prioritizes maternal safety through careful hemodynamic control, interdisciplinary collaboration, and individualized planning. A multidisciplinary team including maternal-fetal medicine, neurology/neurocritical care, anesthesiology, neonatology, and nursing is essential to optimize care for pregnant patients who deliver while recovering from an acute stroke. Stabilization of the mother takes precedence over delivery unless the delivery is necessary to support maternal resuscitation such as in the case of resuscitative cesarean delivery in the setting of maternal deterioration or cardiac arrest.[113]

Blood pressure fluctuations can worsen outcomes in the immediate poststroke period for both ischemic and hemorrhagic strokes.[61] Therefore, close hemodynamic monitoring and strict adherence to blood pressure targets are critical.[111,114,115] Patients with more remote stroke histories may be evaluated prenatally by the appropriate specialists in the outpatient setting, with telemedicine consultations as needed, to determine an appropriate plan for delivery.

Timing of Delivery

Stroke alone is not an indication for immediate delivery. If the maternal condition is stable and the fetus is preterm, continuation of pregnancy is preferred to allow fetal maturation. However, if maternal neurological or cardiovascular status deteriorates, expedited delivery may be warranted. In patients with HDP, delivery timing should follow standard obstetric indications and be guided by maternal benefit, as well as fetal benefit once the mother is stable.[30]

Mode of Delivery

Vaginal delivery is preferred when feasible because it avoids the surgical risks and hemodynamic stress associated with cesarean delivery. Epidural analgesia is beneficial for minimizing pain-induced blood pressure spikes. Assisted vaginal delivery with vacuum or forceps may be considered to shorten the second stage and reduce the Valsalva effort in patients for whom pushing could

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Table 3. Neuroimaging: Radiation Dosing, Safety, Risks/Benefits of Each

Neuroimaging type	Contrast agent	Diagnostic advantages	Diagnostic limitations	Fetal concerns	Breastfeeding/ newborn concerns
CT	None	Easily available Fast High sensitivity for acute hemorrhage	Limited ability to confirm stroke diagnosis Limited visualization of vascular system	Concern: Radiation exposure Impact: Potential increased risk of fetal cancer Data: The estimated radiation dose delivered ranges from <0.001 to 0.1 mGy or "very low dose" per ACOG guidelines.[99,100] Actions: Attempt to limit fetal cumulative dose to <50–100 mGy to decrease risk of fetal cancer. Lead shielding is not recommended and may increase fetal radiation exposure.[101]	None
CT angiography, CT venography, or CT with perfusion	Iodinated	Easily available Rapid visualization of arterial and venous systems, identification of thrombus Can confirm perfusion deficit if present	Quality of scan dependent on correct timing and technique	Concern: Contrast crosses placenta Typical intravenous contrast dose (15–60 g bound, 0.01 g free iodine) above daily dose threshold limits[102] Impact: Potential for fetal hypothyroidism maternal allergic reaction Data: HOCM have been replaced by newer LOCM and IOCM Nonionic most desirable[102] Systematic review, transient thyroid dysfunction in 3/525 neonates.[103] Resolved in all. No reliable in vitro or animal model studies suggest LOCM or IOCM are cytotoxic, mutagenic, or teratogenic at clinical doses.[102] Action: Administer contrast if suspected stroke benefits outweigh risks; limit radiation exposure as much as possible, especially when performing multiple sequential studies (eg, CT, CT angiography, and CT perfusion together)	Potential concern: Potential for direct fetal toxicity and allergic sensitization Data: <1% contrast excreted into breastmilk 1% of that is absorbed by fetal GI tract; ≈100% cleared in 24 h[102] Action: No interruption in breastfeeding required per ACOG; milk flavor may be altered.
MRI, MRA without contrast, MRV without contrast	None	High sensitivity for acute ischemia and edema Time-of-flight imaging can demonstrate stenosis or occlusion in cerebral vasculature	Not readily available in many hospitals Positioning and length of scan may be uncomfortable for mother at later stages of pregnancy May be less specific for acute hemorrhage Time-of-flight not as accurate as contrast imaging	Concern: Magnetic field strength has potential to lead to fetal hyperthermia; loud noise could cause fetal inner ear damage Data: Exposure to MRI during first trimester was not associated with harm (stillbirths, congenital anomalies, neoplasm, vision or hearing loss)[104–106] Action: Magnetic field strength ≤3 T found to be safe	Action: No interruption of breastfeeding per ACOG[99]
MRI with contrast, MRA, MRV, or MR perfusion	Gadolinium	Better characterization of cerebral venous thrombosis compared with time-of-flight imaging Can identify vessel wall enhancement (eg, vasculitis) May better identify septic emboli	Not readily available in many hospitals	Concern: Gadolinium crosses placenta and enters fetal circulation Low-level sequestration in amniotic fluid Impact: Risk of still birth and fetal anomalies Data: 1/3 studies showed increased no risk of fetal or neonatal death if exposed in first trimester*[106–108] Throughout pregnancy, was associated with increased risk of a broad set of rheumatological, inflammatory, or infiltrative skin conditions[106] Action: FDA recommendation: Use only when contrast-enhanced study cannot be delayed and is essential to maternal care and well-being.	Impact: Neonatal death and rheumatological consequences Data: < 0.04% of GBCAs excreted into breastmilk (stable and chelated form) <1% absorbed by fetus No known adverse effects. Action: No interruption of breastfeeding per ACOG

ACOG indicates American College of Obstetricians and Gynecologists; CT, computed tomography; FDA, US Food and Drug Administration; GBCA, gadolinium-based contrast agent; GI, gastrointestinal; HOCM, high osmolar contrast media; IOCM, iso-osmolar contrast media; LOCUM, low osmolar contrast media; MRA, magnetic resonance imaging; MRI, magnetic resonance imaging; and MRV, magnetic resonance venography.

*Limitations of the positive study include that the control group did not undergo MRI.

pose a risk (eg, cervical artery dissection or large stroke with mass effect). Cesarean delivery should be reserved for standard obstetric indications (eg, nonreassuring fetal status, arrest of labor) or when specific conditions preclude labor such as large infarct, active intracranial hemorrhage, elevated intracranial pressure, or recent neurosurgical intervention when straining is contraindicated and assisted vaginal delivery is not possible.

Anesthesia Considerations

Neuraxial anesthesia (epidural or spinal) is generally safe in patients with ischemic stroke without coagulopathy. In hemorrhagic stroke with increased intracranial pressure or in patients receiving anticoagulation, careful risk assessment is needed because of the potential for spinal hematoma.[116] General anesthesia may increase blood pressure variability and cerebral injury, necessitating close hemodynamic monitoring.

Patients taking aspirin may receive neuraxial anesthesia. Those on anticoagulation (eg, heparin or low-molecular-weight heparin) require timing review of their last dose and coagulation status[68] (Table 2). Additional specific obstetric anesthesia considerations after stroke have been reviewed in detail elsewhere.[117]

Postpartum Monitoring and Management

Close monitoring for pregnant or postpartum patients is suggested for at least 24 to 72 hours after an acute stroke in a high-acuity setting (intensive care unit or step-down unit). Blood pressures should be tightly controlled to prevent hypotension and hypertension. Blood pressure targets may be individualized according to the type of stroke.[111,114,115] Postpartum patients with stroke may be at higher risk for cerebral vasospasm, especially those with preeclampsia, reversible cerebral vasoconstriction syndrome, recent SAH, or recent mechanical thrombectomy. We suggest avoiding sympathomimetics, serotonergic medications, and ergot derivatives (eg, methylergonivine)[118] in these patients if possible and monitoring for recurrent neurological symptoms, including severe headache or focal neurological deficits.

Most stroke-related medications, including anti-seizure medications and some anticoagulants, are compatible with breastfeeding. Individualized counseling should be provided to support informed postpartum care decisions.

STROKE RECOVERY IN THE PREGNANT OR POSTPARTUM INDIVIDUAL

Rehabilitation Considerations

Depending on the type and severity of stroke, at least one-third of pregnant or postpartum patients will experience residual deficits.[119] These may include physical impairments (eg, hemiparesis), cognitive challenges (eg, memory or language difficulties), and psychosocial challenges such as depression or anxiety. Stroke recovery is further complicated by the demands of new parenthood such as caring for an infant and breastfeeding. As young stroke survivors, these patients may also face disruption of prestroke responsibilities such as employment, caregiving, and household responsibilities. A population-based cohort study from Finland found that 90% of maternal stroke survivors were functionally independent as measured by the modified Rankin Scale,[8] highlighting the potential for recovery.

Current guidelines for stroke rehabilitation recommend a multidisciplinary team approach including vascular neurology, stroke nursing, physical therapy, occupational therapy, speech-language pathology, psychology, nutrition, social work, and physiatry.[120] Engaging family members, caregivers, and support networks in rehabilitation planning and goal setting is important. Postdischarge rehabilitation options may include an inpatient rehabilitation facility, home rehabilitation services, or outpatient rehabilitation therapies,[120] depending on the severity of a patient's deficits and their home supports. Although early and intensive rehabilitation improves functional recovery, postpartum patients may face barriers such as separation from their newborn. These factors should be considered when planning discharge and follow-up care.

Longitudinal follow-up care with a vascular neurologist is important to support recovery. Screening for post-stroke complications common in younger adults such as cognitive impairments, lethargy, and seizures can support more compatible recovery.[121,122]

Lactation

Breastfeeding and pumping breastmilk are often feasible for lactating stroke survivors but may require adaptations. For example, patients with hemiparesis may need assistance with infant positioning or operating the breast pump. Collaboration with physical therapy, occupational therapy, and lactation specialists can help ensure success.

When prescribing secondary stroke prevention medications, clinicians should consider the patient's lactation goals. In some cases, the benefits of medication outweigh the risks of breastfeeding, and shared decision-making is essential (Table 2).

Contraception

Contraceptive counseling should address the patient preferences, stroke cause, and any underlying hypercoagulable conditions. Estrogen-containing contraceptives (eg, pill, patch, ring), are associated with an increased stroke risk,[123] particularly in individuals with additional risk factors such as tobacco use, hypertension, diabetes,

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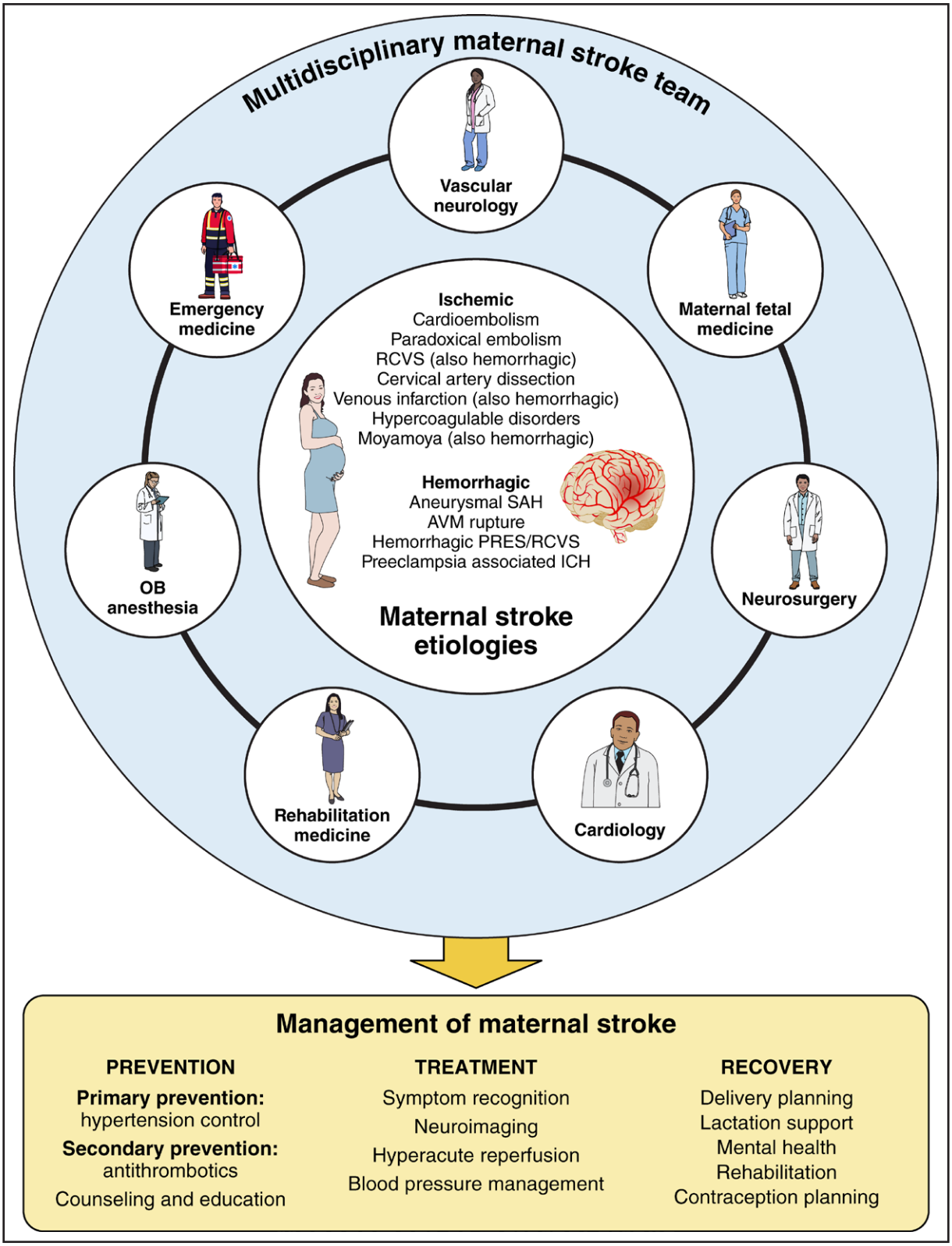

Figure 2. Maternal stroke: prevention, treatment, and recovery.
AVM indicates arteriovenous malformation; ICH, intracerebral hemorrhage; OB, obstetric; PRES, posterior reversible encephalopathy syndrome; RCVS, reversible cerebral vasoconstriction syndrome; and SAH, subarachnoid hemorrhage.

hypercholesterolemia, migraines, obesity, and thrombophilia. Progestin-only methods (oral, intrauterine device, or implant) have not been shown to significantly increase the risk of arterial or venous thrombosis formation or subsequent stroke.[124] Nonhormonal contraceptive options such as a copper intrauterine device or barrier methods may also be considered. Poststroke counseling should ideally involve the vascular neurologist and obstetrician and include discussion of future pregnancy plans during the postpartum or preconception period.[97] Clinicians are encouraged to review the 2024 Centers for Disease Control and Prevention medical eligibility criteria for guidelines on contraception use in the context of comorbidities.[123]

Anxiety, Depression, Sexual Dysfunction, and Sleep Disturbances

Mood and sleep disorders are common after stroke and may be intensified by postpartum factors such as hormonal shifts, infant care demands, and disrupted sleep. In addition, severe maternal morbidity (including pregnancy-related stroke) is associated with higher risk of postpartum mood disorders.[125,126] Poststroke fatigue, anxiety, and depression often co-occur and may hinder recovery, interfere with daily functioning, and worsen long-term outcomes. Routine screening with validated tools (eg, General Anxiety Disorder-7, Patient Health Questionnaire-9, Edinburgh Postnatal Depression Scale)[127–129] for anxiety and depression is suggested. Poor-quality sleep is associated with more poststroke fatigue, worse functional outcomes, and higher stroke recurrence risk after stroke[130,131]; thus, we advise screening for insomnia, restless legs, obstructive sleep apnea, and other sleep disorders in pregnant and postpartum stroke survivors.

Sexual dysfunction affects more than half of stroke survivors but is often overlooked in clinical care. Addressing sexual health and intimacy concerns can improve quality of life for both the patient and their partner.

When identified, these conditions should be managed with appropriate pharmacological treatment, behavioral therapy, and referral to mental health specialists as needed. Obstetrician-gynecologist clinics that have integrated mental and behavioral health clinicians into their postpartum clinic are a best practice and can improve mental health outcomes.[132]

CONCLUSIONS

Stroke remains a rare but life-threatening complication of pregnancy, with significant implications for both maternal and neonatal health. Despite advances in obstetric and neurological care, the diagnosis and management of pregnancy-associated stroke continue to be challenged by delayed recognition, a lack of tailored clinical guidelines, and persistent disparities in outcomes. The disproportionate burden of stroke on high-risk populations, particularly those with HDP and preexisting comorbidities and those from historically marginalized communities, underscores the urgent need for equitable, evidence-based care models.

Because strokes often occur during the peripartum or early postpartum period and may present with nonfocal symptoms such as severe headache, heightened clinical awareness is essential. Hemorrhagic strokes make up nearly half of all maternal stroke cases, unlike in the general population, and require timely differentiation from ischemic and venous subtypes to guide appropriate treatment. Although randomized controlled trial data are lacking because of the systematic exclusion of pregnant and lactating individuals in stroke trials, the growing body of observational research provides a foundation for informed decision-making.

This scientific statement represents a multidisciplinary effort to synthesize current knowledge and to offer consensus-driven suggestions for prevention, acute management, and postpartum recovery in maternal stroke. Emphasizing individualized, team-based care, it aims to close knowledge gaps and to support clinicians navigating these complex cases (Figure 2). Continued research, including inclusive clinical trials, is urgently needed to refine stroke risk assessment, to expand treatment options, and to improve maternal outcomes. Until then, coordinated care, early recognition, and patient-centered approaches remain critical to reducing the devastating impact of stroke in pregnancy and the postpartum period.

ARTICLE INFORMATION

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

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*Modest.

†Significant.

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†Significant.

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