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Epilepsy in Pregnancy: Optimization of Maternal-Fetal Outcomes

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Abstract: ***Epilepsy is a chronic neurological disorder characterized by a predisposition to recurrent, unprovoked epileptic seizures resulting from abnormal, excessive, or synchronous neuronal activity in the brain. Pregnancy in women with epilepsy requires multidisciplinary management because physiological changes during gestation may alter antiseizure medication (ASM) pharmacokinetics, affect seizure control, and influence maternal and fetal outcomes. Although most women with epilepsy experience favorable pregnancy outcomes, the risks of congenital malformations, fetal growth restriction, maternal injury, and pregnancy-related complications vary according to seizure control, the specific medication used, dosage, and the presence of comorbidities. Optimal management includes preconception counseling, individualized ASM selection, folic acid supplementation, regular neurological and obstetric assessment, appropriate fetal surveillance, and careful intrapartum and postpartum planning. Epilepsy alone is not an indication for cesarean delivery, and breastfeeding is generally encouraged with appropriate medication-specific counseling. This review summarizes the principal clinical considerations in the management of epilepsy during pregnancy, labor, delivery, and the postpartum period.***

Keywords: Epilepsy; pregnancy; antiseizure medications; maternal health; fetal outcomes; labor; breastfeeding; contraception

1. Introduction

Epilepsy is a neurological disorder characterized by an enduring predisposition to epileptic seizures caused by abnormal electrical activity within neuronal networks. It affects women of reproductive age and presents important clinical considerations during pregnancy, childbirth, and the postpartum period.

Epilepsy is not, in itself, a contraindication to pregnancy. Most women with epilepsy can anticipate a successful pregnancy and the birth of a healthy infant, particularly when seizure control is optimized before conception and treatment is carefully monitored throughout pregnancy. Nevertheless, pregnancy may alter seizure frequency and antiseizure medication concentrations, necessitating individualized management and coordinated care by obstetricians, neurologists, and other relevant healthcare professionals.

Pregnancy-related physiological changes, including increased plasma volume, alterations in protein binding, enhanced renal clearance, and changes in hepatic drug metabolism, may reduce the serum concentrations of certain antiseizure medications. Nausea and vomiting may further compromise medication adherence and absorption. Consequently, maintaining seizure control while minimizing fetal exposure to potentially teratogenic medications is a central objective of clinical management.

Maternal generalized tonic–clonic seizures may cause trauma, maternal hypoxemia, fetal hypoxia, and, in severe cases, placental abruption. Moreover, certain antiseizure medications are associated with an increased risk of congenital malformations and adverse neurodevelopmental outcomes. These considerations underscore the importance of preconception counseling, appropriate pharmacological management, and structured antenatal surveillance.

2. Preconception Counseling and Risk Assessment

Preconception counseling is an essential component of care for women with epilepsy who are planning pregnancy. The principal objectives are to optimize seizure control, minimize fetal exposure to potentially teratogenic medications, and identify individual risk factors before conception [1, 2].
The preconception assessment should include:

a) Confirmation of the epilepsy diagnosis, seizure type, epilepsy syndrome, seizure frequency, and history of generalized tonic–clonic seizures.
b) Review of the current ASM regimen, including dosage, adherence, adverse effects, and potential drug interactions.
c) Assessment of previous pregnancy outcomes, congenital anomalies, and relevant medical comorbidities.
d) Development of an individualized treatment plan, preferably before conception.
e) Counseling regarding folic acid supplementation, contraception, breastfeeding, and maternal and neonatal safety.

Whenever clinically appropriate, treatment with a single antiseizure medication (monotherapy) at the lowest effective dose is preferred over polytherapy because exposure to multiple medications may increase fetal risk. However, seizure control must not be compromised merely to achieve monotherapy.

Lamotrigine, levetiracetam, and oxcarbazepine are among the medications that may be considered when clinically appropriate, depending on the epilepsy syndrome, previous treatment response, and comorbidities. Valproate should be avoided in women of childbearing potential whenever clinically feasible because of its association with major congenital malformations, neural tube defects, and adverse neurodevelopmental outcomes [1,2].

An established antiseizure regimen should not be discontinued abruptly during pregnancy. Changing or withdrawing an effective medication after conception may precipitate breakthrough seizures and expose both mother and fetus to additional risks. Any treatment modification should be undertaken through specialist assessment and shared decision-making [1,3].

3. Maternal and Fetal Risks

3.1 Maternal Risks

Most pregnant women with epilepsy have favorable outcomes. Nevertheless, pregnancy and the postpartum period may be associated with increased seizure frequency in some patients, particularly when medication adherence is poor or serum drug concentrations decline.

Potential maternal complications include:

1) Generalized tonic–clonic seizures and status epilepticus.
2) Falls, trauma, and accidental injury.
3) Maternal hypoxemia and associated fetal compromise.
4) Obstetric complications secondary to severe seizures, including placental abruption.
5) Increased risk of epilepsy-related mortality, including sudden unexpected death in epilepsy (SUDEP).

The risk varies according to seizure type, seizure control before conception, medication adherence, and the presence of additional medical or obstetric risk factors. Maintaining seizure control, ensuring medication adherence, and providing appropriate specialist follow-up are therefore central to maternal safety [1,3].

3.2 Fetal and neonatal risks

Fetal risks arise from both maternal seizures and exposure to antiseizure medications. The nature and magnitude of medication-associated risk depend on the specific drug, dosage, combination therapy, and other maternal factors.

Potential adverse outcomes include:

1) Major congenital malformations, including neural tube defects.
2) Fetal growth restriction and small-for-gestational-age birth.
3) Adverse neurodevelopmental outcomes associated with certain medications, particularly valproate.
4) Fetal hypoxia or trauma associated with severe maternal convulsive seizures.

It is important to distinguish medication-associated teratogenicity from complications attributable to poorly controlled epilepsy. Appropriate counseling should explain both risks without encouraging patients to stop necessary treatment [1, 2].

4. Antenatal Management

4.1. Multidisciplinary care and clinical follow-up

Pregnant women with epilepsy should receive coordinated care involving an obstetrician, neurologist, and, when indicated, a maternal–fetal medicine specialist. The frequency of follow-up should be individualized according to seizure control, medication-related risks, comorbidities, and obstetric findings.

At antenatal visits, clinicians should assess:

a) Seizure frequency, duration, type, and associated symptoms.
b) Medication adherence and adverse effects.
c) Nausea, vomiting, dizziness, fatigue, and other symptoms that may affect treatment.
d) Changes in seizure patterns or potential triggers, including sleep deprivation.
e) The need for medication adjustment and additional fetal surveillance.

Women should be encouraged to maintain a seizure diary and medication record. They should also receive clear instructions regarding when to seek urgent medical assessment.

4.2 Antiseizure medication monitoring

Pregnancy can substantially alter the pharmacokinetics of certain ASMs. Increased plasma volume, changes in protein binding, and enhanced renal or hepatic clearance may reduce circulating drug concentrations. The magnitude of these changes varies considerably among medications and patients.

Lamotrigine and levetiracetam, for example, may exhibit clinically important declines in serum concentrations during pregnancy. When available and clinically indicated, therapeutic drug monitoring can help identify these changes and guide dosage adjustments. A preconception serum concentration associated with satisfactory seizure control may provide a useful individual reference [3,4].

Monitoring should be guided by the medication used, clinical history, seizure frequency, and availability of laboratory testing. If the dosage is increased during pregnancy, a postpartum dose-reduction plan should be established in advance because drug clearance may normalize rapidly after delivery.

4.3 Folic acid supplementation

Folic acid supplementation is recommended for women with epilepsy who are planning pregnancy and for those who are already pregnant and taking antiseizure medications. Supplementation should ideally begin before conception and continue during pregnancy.

The 2024 guideline from the American Academy of Neurology, American Epilepsy Society, and Society for Maternal-Fetal Medicine recommends at least 0.4 mg of folic acid daily before conception and throughout pregnancy for women treated with ASMs [1].

Higher doses, commonly 4–5 mg daily in some national guidelines and high-risk clinical protocols, may be prescribed according to individual risk factors and local guidance. However, the optimal dose for every antiseizure medication regimen has not been definitively established. The dose should therefore be determined by the treating clinician rather than applied universally.

Folic acid supplementation is particularly important because of the association between certain ASMs, especially valproate, and neural tube defects. Nevertheless, supplementation does not eliminate medication-associated teratogenic risk [1,2].

4.4 Fetal assessment and ultrasonographic surveillance

Epilepsy itself is not generally considered a cause of chromosomal aneuploidy. However, exposure to certain ASMs may increase the risk of structural congenital anomalies.

Routine prenatal screening should be offered in accordance with standard obstetric recommendations. A detailed fetal anatomical ultrasound is generally performed at approximately 18–22 weeks of gestation, with the precise timing determined by local protocols and clinical circumstances.

Maternal serum alpha-fetoprotein (AFP) testing may be considered according to the local prenatal screening pathway, particularly when assessing the risk of open neural tube defects. AFP testing and ultrasonography are complementary approaches; neither should be interpreted in isolation.

Fetal growth surveillance should be individualized according to the medication regimen and other risk factors. Because fetal growth restriction has been associated with exposure to certain ASMs, particularly valproate and topiramate, serial growth ultrasonography may be appropriate when clinically indicated. The timing and frequency of scans should be determined by the obstetric team rather than applied as a fixed schedule to every woman with epilepsy [1,2].

Cardiotocography (CTG) is not required solely because a woman has epilepsy. Its use should be guided by gestational age, fetal status, maternal complications, and standard obstetric indications.

5. Management During Labor and Delivery

5.1 Planning for labor

Most women with epilepsy can undergo vaginal delivery, and epilepsy alone is not an indication for cesarean section. The mode of delivery should be determined by obstetric indications, maternal condition, fetal status, and the circumstances of any seizure occurring during labor [3,5].

The intrapartum management plan should include:

a) Continuation of the prescribed ASM regimen at the scheduled times.
b) Avoidance of missed doses, including when oral intake is restricted.
c) A plan for alternative medication administration if oral treatment is not possible.
d) Adequate analgesia and attention to sleep deprivation, dehydration, and exhaustion.
e) Early anesthetic consultation when clinically indicated.
f) Access to emergency treatment for acute seizures.

A calm environment and appropriate pain management may help reduce stress and improve the overall experience of labor. However, these measures do not replace pharmacological seizure prevention.

5.2 Management of an acute seizure during labor

A generalized convulsive seizure during labor requires immediate assessment and treatment. Initial management should prioritize maternal airway protection, breathing, circulation, prevention of injury, and identification of reversible causes. The duration of the seizure and maternal oxygenation should be assessed, and fetal monitoring should be initiated as soon as feasible after maternal stabilization.

For a prolonged convulsive seizure or status epilepticus, an intravenous benzodiazepine, such as lorazepam, may be administered according to the emergency protocol. Persistent seizures require escalation to second-line antiseizure treatment and critical-care management when indicated.

If a seizure occurs for the first time during late pregnancy or the postpartum period, eclampsia must be considered urgently, even in a woman with a known history of epilepsy. The differential diagnosis should also include metabolic disturbances, medication toxicity or withdrawal, and other neurological emergencies.

Magnesium sulfate is the standard anticonvulsant treatment for eclampsia but is not the routine treatment for an epileptic seizure unrelated to eclampsia. When the diagnosis is uncertain, urgent obstetric assessment and treatment should not be delayed [5].

5.3 Fetal monitoring and mode of delivery

Maternal convulsive seizures may cause transient fetal bradycardia due to maternal hypoxemia and altered uteroplacental perfusion. Continuous fetal heart-rate monitoring should be considered during and following a significant intrapartum seizure, depending on gestational age and clinical circumstances.

If the fetal heart-rate pattern deteriorates, clinicians should first stabilize the mother and assess whether the fetal abnormality resolves. Persistent fetal compromise despite maternal stabilization may require expedited delivery.

The occurrence of a seizure does not automatically necessitate cesarean delivery. The decision should be based on the maternal response to treatment, fetal heart-rate pattern, stage of labor, and relevant obstetric indications.

6. Postpartum Management

The postpartum period requires continued attention to seizure control, medication dosing, sleep, and maternal safety. Sleep deprivation, exhaustion, and missed medication doses may increase seizure risk during the first days and weeks after delivery.

Women whose ASM doses were increased during pregnancy should have a documented plan for postpartum reassessment

and dose adjustment. Because the pharmacokinetic changes of pregnancy may reverse rapidly after delivery, continuing an increased dose without review may result in excessive drug exposure and adverse effects.

Postpartum counseling should address:

a) Strict adherence to the prescribed medication schedule.
b) Adequate rest and practical support from family members.
c) Recognition of seizure recurrence and medication-related adverse effects.
d) Safe infant-care practices if seizures remain uncontrolled.
e) Follow-up with the neurology and obstetric teams.
f) Selection of an appropriate contraceptive method.

Women should be advised to avoid bathing an infant alone in a full bathtub, to change or feed the baby in a safe position when seizure risk is present, and to arrange assistance when needed. These precautions should be tailored to the individual's seizure history and functional status [3,5].

7. Breastfeeding

Breastfeeding should generally be encouraged in women with epilepsy because of its nutritional, immunological, and developmental benefits. The use of an ASM is not, by itself, a contraindication to breastfeeding.

Most commonly used ASMs can be compatible with breastfeeding, although the degree of transfer into breast milk and the potential for infant adverse effects vary by medication. Counseling should therefore be medication-specific and should consider maternal seizure control, the infant's gestational age, and any neonatal health concerns [3,5].

Parents should be advised to seek clinical assessment if the infant develops unusual sedation, poor feeding, inadequate weight gain, or other concerning symptoms. Breastfeeding decisions should balance the benefits of breastfeeding against the specific risks associated with the medication rather than rely on a blanket prohibition.

8. Contraception and Drug Interactions

Contraceptive counseling is an important component of long-term epilepsy care, particularly for women receiving enzyme-inducing ASMs.

Medications such as carbamazepine, phenytoin, phenobarbital, and certain other enzyme-inducing agents can increase hepatic metabolism of hormonal contraceptives and reduce their effectiveness. This interaction may increase the risk of unintended pregnancy.

The effect varies according to the specific medication and contraceptive formulation. Options should be reviewed individually, with consideration of intrauterine contraception and other methods less affected by hepatic enzyme induction. Levonorgestrel-releasing intrauterine devices are generally not subject to the same clinically significant reduction in contraceptive effectiveness associated with enzyme-inducing ASMs as some systemic hormonal methods.

The interaction may also operate in the opposite direction: estrogen-containing contraceptives can reduce lamotrigine concentrations and potentially compromise seizure control. Women starting or discontinuing hormonal contraception should therefore be assessed for clinically significant changes in seizure frequency or medication levels [3,6].

Effective contraception and preconception counseling are especially important for women taking medications associated with greater fetal risk, particularly valproate. Any decision to change an ASM in preparation for pregnancy should be made under specialist supervision.

9. Discussion

The management of epilepsy during pregnancy requires a careful balance between preventing maternal seizures and minimizing fetal exposure to potentially harmful medications. The available evidence supports preconception optimization of treatment, individualized risk assessment, regular antenatal follow-up, and coordinated planning for delivery and postpartum care.

A major principle of contemporary management is that uncontrolled convulsive seizures may pose substantial risks to both mother and fetus. Consequently, medication withdrawal during pregnancy should not be undertaken without specialist supervision. Treatment decisions should be based on the woman's epilepsy syndrome, previous response to therapy, seizure history, medication-specific fetal risks, and informed preferences [1,3].

The 2024 practice guideline developed by the American Academy of Neurology, American Epilepsy Society, and Society for Maternal-Fetal Medicine emphasizes the importance of minimizing generalized tonic–clonic seizures, selecting medications with more favorable pregnancy safety profiles when clinically appropriate, and providing folic acid supplementation before conception and during pregnancy [1].

Intrapartum care should prioritize medication continuity, maternal stabilization, timely treatment of acute seizures, and appropriate fetal monitoring. Epilepsy alone does not necessitate cesarean delivery. Similarly, breastfeeding should generally be supported, with appropriate counseling regarding the specific ASM and potential neonatal adverse effects [5].

Individualized postpartum planning is equally important because medication requirements may change rapidly after delivery, while sleep deprivation and disrupted medication schedules may increase seizure risk. Effective contraception and counseling about future pregnancies should therefore be incorporated into routine neurological care.

10. Conclusion

Epilepsy is not a contraindication to pregnancy, and most women with epilepsy can achieve favorable maternal and neonatal outcomes with appropriate clinical management. Successful care requires preconception counseling, rational selection of antiseizure medications, folic acid supplementation, monitoring of seizure control and

medication concentrations when indicated, and individualized fetal surveillance.

During labor, continuation of antiseizure therapy, appropriate analgesia, prompt management of acute seizures, and assessment of fetal well-being are essential. The mode of delivery should be determined by obstetric indications rather than the diagnosis of epilepsy alone. After delivery, medication doses should be reviewed, breastfeeding should generally be encouraged, and effective contraception should be discussed.

Ultimately, multidisciplinary, evidence-based care that balances maternal seizure control with fetal safety provides the foundation for optimizing pregnancy outcomes in women with epilepsy.

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