

REVIEW

Migraine Throughout a Woman's Life: A Guide to Management

Delora E. Denney, BA¹, Matthew Hendry, BS², Nader Pahlevan, BA², Ahmed Ayaz, MD³, Delora Ann Denney, MD⁴

¹ School of Medicine, University of Mississippi Medical Center, ² School of Medicine, University of Mississippi Medical Center, ³ Department of Neurology, University of Mississippi Medical Center, ⁴ Picayune Family Care Center

Keywords: women, migraine, menstrual migraine, hormones, pregnancy, hormonal contraception

<https://doi.org/10.67225/001c.117919>

Journal of the Mississippi State Medical Association

Vol. 65, Issue 5/6, 2024

Purpose of Review

Migraine is both an important and prevalent disease affecting the health of women. The purpose of the current review is to describe how migraine can change throughout a woman's life in conjunction with hormonal fluctuations and to detail what treatments can be used to combat these hormonal changes. Additionally, menstrual migraine, medications safe in pregnancy, and hormonal contraception are discussed.

Recent Findings

Contrary to popular belief, hormonal contraception can be used in women who have migraine with aura, precluding other contraindications. Preliminary data is now available on the safety of the newest migraine drugs in pregnancy.

Summary

Despite it being one of the largest sources of disability globally, especially among women, migraine remains a poorly understood disease by many medical professionals. The levels of the hormones estrogen and progesterone vary greatly throughout a woman's life, such as in menarche, menstrual cycling, pregnancy, perimenopause, and menopause which can all affect migraine patterns. Menstrual migraine may require special prophylactic therapy with NSAIDs, triptans, or estradiol. Migraine can pose increased challenges during pregnancy, especially with more limited treatment options approved. When prescribing hormonal contraception, migraine should be an important consideration.

Introduction

Migraine is the second leading cause of years lived with disability worldwide¹ and thus is likely to be present throughout life in those affected. It is more common in women than men,² a trend which can be attributed partly to the influence of hormones like estrogen and progesterone. Specifically, menarche, menstrual cycling, pregnancy, perimenopause, and menopause all affect migraine patterns as a function of their impact on estrogen and progesterone levels.³

Migraine disease is characterized by recurrent episodes of moderate to severe headache and associated symptoms.⁴ The International Classification of Headache Disorders 3rd edition (ICHD-3) sets forth criteria for migraine

diagnosis including attack duration of 4-72 hours (when untreated or unsuccessfully treated); at least 2 of the following 4: unilateral location, pulsating quality, moderate or severe pain intensity, aggravation by or avoidance of routine physical activity; and 1 of the following: photophobia and phonophobia or nausea or vomiting.⁵ Migraine can be “episodic,” with less than 15 headache days per month, or “chronic,” with at least 15 headache days a month (at least 8 of which are migraine days) for more than 3 months.⁵ Migraine disease stems from the brain and its associated tissues. The major contributing areas involved in migraine are the central nervous system, the peripheral nervous system, and the trigeminovascular system; however, the precise pathophysiology of a migraine attack is not fully understood.⁶ Calcitonin Gene Related Peptide (CGRP) has been more recently implicated in migraine pathophysiology as it increases during migraine attacks, and blocking CGRP has proved to be an effective treatment for migraine.⁷ Migraine has a strong genetic component as well, with an estimated heritability of 34-64%.⁸ Migraine is three times more common in females than males, and one out of every four women will experience migraine at some point in her life.²

Both estrogen and progesterone can exert positive and negative effects on migraine, depending on their levels in the blood and length of exposure.⁹ The hormones estrogen and progesterone play critical roles in female reproduction, and the levels of these hormones change and vary through different stages of development in a woman's life.¹⁰

Menarche

In children, migraine is more common in boys than girls.¹¹ This trend reverses when females go through menarche, and migraine becomes much more prevalent in women.¹⁰ The rate of migraine in females is 2 to 3 times higher than in males during the female reproductive years.¹² This figure would suggest that the increase in female sex hormones that comes with puberty is implicated in the pathogenesis of migraine.¹³

Menstrual Cycle

The menstrual cycle is another prominent event that influences migraine. In women with a normal menstrual cycle, the cycle has two phases: follicular and luteal, which occur over approximately 28 days. The follicular phase begins on the first day of menstruation and goes through ovulation. During this time, there is an increase in both estrogen and progesterone.¹⁰ Concurrently, the pituitary gland releases follicle-stimulating hormone (FSH) to develop follicles and subsequently an oocyte. As the oocyte goes through the ovulation process, estrogen is released and exerts negative feedback on FSH. The pituitary gland then releases luteinizing hormone (LH) which allows the mature oocyte to be released through rupturing of the follicle. Although progesterone does peak slightly preceding ovulation, it stays predominately

low throughout the follicular phase. In the luteal phase, commencing just after ovulation, estrogen and progesterone are given off by the follicle and received by the endometrium which prepares for fertilization. If no fertilization occurs, the levels of estrogen and progesterone fall after about 14 days, and the endometrium is shed through bleeding.¹⁰ This drop in estrogen can trigger a migraine attack.¹⁴

The most prominent effect on migraine occurs two days before bleeding begins as estrogen begins to drop and carries on for three days into bleeding.¹⁰ One study administered estrogen-only and progesterone-only to women around two days before bleeding began. Estrogen injections were shown to have a preventative effect on migraine attacks, whereas progesterone made no difference in migraine attack frequency near and during the onset of bleeding, implicating estrogen drop as a migraine attack trigger.¹²

Pregnancy

Pregnancy also has an interesting effect on migraine, as migraine frequency steadily improves from the first to the third trimester of pregnancy but returns to baseline frequency post-partum.¹⁰ Here, estrogen and progesterone seem to have a protective effect as they are both found in high concentrations throughout the pregnancy. In the third trimester of pregnancy, progesterone levels are approximately 20 times higher than normal progesterone peaks, and estrogen levels are approximately 30 to 40 times higher than peak levels when compared to a normal menstrual cycle. If the new mother chooses to breastfeed, studies have shown that the migraine reduction seen in pregnancy will remain for around three months, likely due to the negative feedback of prolactin on the estrogen and progesterone pathway, keeping levels low but stable. While it seems reasonable to wonder why the drop of estrogen does not lead to increased migraine attack occurrence, studies show that women who exclusively breastfeed have a continuation of migraine improvement similar to that of pregnancy. One possible explanation is the higher levels of endogenous opioids present in the post-partum period are protective. Women who do not breastfeed can experience migraine recurrence as soon as one week following parturition.^{12, 15,16}

Conversely, studies have reported that pregnancy can cause new-onset migraine in almost 10% of patients, with some studies reporting an incidence as high as 17%.¹⁷ It has also been reported that around 10% of patients with existing migraine without aura have experienced new-onset auras during pregnancy.¹⁸

Perimenopause

The fluctuation of hormones during perimenopause often increases the frequency of migraine attacks that women experience. Perimenopause is marked by high variability in estrogen levels in particular. During this period, women will experience dramatic increases and decreases in estrogen levels until the levels ultimately decline definitively in the menopausal period.¹⁰ The frequency of migraine attacks in women with menstrual migraine appears to increase during the perimenopausal period, particularly the late perimenopausal period.¹⁹ This is likely related to the frequent drops in estrogen precipitated by the rapidly fluctuating estrogen levels in this period, as estrogen withdrawal is found to trigger migraine attacks in women with menstrual migraine.²⁰ Women without a hormonal trigger for migraine attacks generally experience a similar frequency of attacks in the perimenopausal period as they did prior.¹⁹

Menopause

Once in menopause, migraine attack frequency tends to reduce. However, if menopause is surgically induced, migraine attack frequency does not lower as much as in naturally occurring menopause. The reason for migraine improvement is likely stable levels of hormones, in contrast to the hormonal changes taking place each month in a natural menstrual cycle. Migraine can worsen in some women because there is a drop in estrogen in menopause, but, as the interval from menopause onset increases, an overall improvement in migraine is seen.¹⁰

Menstrual Migraine and Treatment

The ICHD-3 divides menstrual migraine into two broad types: pure menstrual migraine and menstrually-related migraine. Pure menstrual migraine allows for attacks meeting the criteria for migraine to occur on days -2 to +3 of menstruation only and at no other times of the month.⁵ This type represents a minority of menstrual migraine with fewer than 10% of women reporting migraine attacks exclusively in conjunction with the onset of menstruation.²¹ However, over 50% of women do report their migraine is associated with menstruation, just not exclusively on days -2 to +3.²¹ These women likely have menstrually-related migraine, with attacks occurring notably on days -2 to +3 but also at other times during their menstrual cycle.

First-line treatment for menstrual migraine attacks can be the same as treatment for non-menstrual migraine attacks. Patients can be advised to take their normal acute migraine attack therapy.²² However, menstrual migraine attacks are known to be refractory to therapy and may require a different approach to treatment.²³ Multiple therapies may be considered for short-term daily prophylaxis of menstrual migraine attacks. If the patient endorses significant dysmenorrhea or menorrhagia, non-steroidal anti-inflammatory

Table 1. Prophylactic Management of Menstrual Migraine

	NSAIDs	Triptans	Estradiol	CHC
Frequency	Daily	Twice daily	Daily	Daily
Duration	2 days before menses until day 5-7 of the menstrual cycle ²⁴	2 days before menses and continued until day 5-7 of the menstrual cycle ²⁴	Throughout the menstrual cycle until day 7, tapering on the last two days ²²	Continuous ²²
Preferred Agent and Dosage	N/A	Frovatriptan 2.5 mg twice a day starting 2 days before menses, total of 6 days ²⁴	Estradiol 1.5 mg ²²	CHC with $\leq$ 25 mcg estrogen ²³

drugs (NSAIDs) may be the preferred choice. Daily treatment should begin 2 days before the onset of menses and continue until day 5-7 of the menstrual cycle.²⁴ Triptans can also be used in the same fashion for the same duration. Frovatriptan, which offers the advantage of a longer half-life, can be dosed at 2.5 mg twice a day starting two days before menses for a total of six days.²⁵ Finally, several forms of estradiol (pills, cream, patches) can be used throughout the menstrual cycle to prevent a drop in estrogen levels. Daily use of 1.5 mg of estradiol during menses should be continued until day seven of the cycle with the last two days serving to taper down the estrogen dose as physiologic estrogen begins to rise. If this particular therapy protocol is not strictly followed, exogenous estrogen drop-off can result in a migraine attack.^{22,24}

Treatment of Migraine in Pregnancy

Acute treatment options for migraine attacks during pregnancy include acetaminophen, NSAIDs, and triptans. Acetaminophen has traditionally been considered an effective first-line option at a dose of 1000 mg.^{26,27} NSAIDs are generally considered safe to use in the second trimester of pregnancy. In the first trimester, NSAID use has been associated with a possible increased risk of miscarriage and congenital malformations.²⁶ They are not recommended during the third trimester due to the increased risk of complications, such as premature closure of the ductus arteriosus, impaired renal function, cerebral palsy, and neonatal intraventricular hemorrhage.^{26,28} Recommended NSAIDs and doses include Naproxen 200 mg, Ibuprofen 400-600 mg, and Diclofenac 100 mg.^{27,29} Triptans can also be effective and safe in treating acute migraine attacks during pregnancy. Three large pregnancy registries in the US, Canada, and Norway, with over 70,000 patients, have concluded that the risk of their use in pregnancy is negligible.³⁰⁻³² Of the triptans, sumatriptan has the most robust evidence for safe use in pregnancy and can be dosed orally at 50-100 mg, subcutaneously at 4-6 mg, or intranasally at 5-20 mg.^{26,27} Intranasal delivery of sumatriptan results in low maternal serum concentration compared to the tablet form, and it maintains efficacy even in the presence of gastric stasis or nausea, which are common in the first trimester.³³

Table 2. Treatment of Migraine in Pregnancy

Acute	Preferred Agent and Dosage	Prevention	Preferred Agent and Dosage
Acetaminophen ^{26, 27}	1000 mg ²⁷	Beta-Blockers ²⁷	Propranolol 40-240 mg, Metoprolol 50-200 mg ³⁴
NSAIDS ^{*27,29}	Naproxen 200 mg, ibuprofen 400-600 mg, diclofenac 100 mg ²⁷	Tricyclic Antidepressants ²⁷	Amitriptyline 10-50 mg ³⁴
Triptans ^{26,27}	Sumatriptan 50- 100 mg orally, 4-6 mg subcutaneously, or 5-20 mg intranasally ^{27,33}	Botulinum toxin type A ²⁶	N/A

*second trimester only

Gepants (Ubrogepant, Rimegepant, Zavegepant) are a new class of small-molecule CGRP antagonists that are Food and Drug Administration (FDA)-approved and can thus be used for acute migraine attack treatment; however, data for their use in pregnancy is limited. Gepants are presently not recommended for use in pregnancy by the American College of Obstetrics and Gynecologists' Clinical Practice Guidelines (ACOG).³⁵

Preventive treatment options for migraine in pregnancy include beta-blockers, tricyclic antidepressants (TCA), and onabotulinumtoxinA. Beta-blockers, specifically propranolol (40-240 mg) and metoprolol (50-200 mg),^{27,34} are considered the first-line treatment option for migraine prevention in pregnant women.³⁶ The TCAs are a safe second-line treatment option when beta-blockers cannot be used or are ineffective and are generally considered safe. Of the TCAs, Amitriptyline (10-50 mg) is the preferred choice.^{26,34} Botulinum toxin type A is a third-line treatment generally considered safe during pregnancy due to its localized mechanisms of action.²⁶ A retrospective analysis with 29 years of data showed that pregnant women receiving onabotulinumtoxinA showed no difference from the general population in the prevalence of major fetal defects.³⁷

CGRP inhibitor monoclonal antibodies (Erenumab, Fremanezumab, Galcanezumab, Eptinezumab-jjmr) are a relatively new class of medications used in the preventive treatment of migraine. There is limited data on their safety and efficacy during pregnancy. From current data, no specific maternal toxicities, increased risk of spontaneous abortion, or patterns of major birth defects have been reported with their use in pregnancy.³⁸

One study that looked at 30,555 pregnancies showed patients with pre-pregnancy migraine have a higher risk of preterm delivery, gestational hypertension, and preeclampsia. The risk of preeclampsia specifically was even higher for patients with migraine with aura than migraine without aura. Participants with migraine who reported regular prepregnancy aspirin use had lower risks of preterm delivery.³⁹

Hormonal Contraception and Migraine

Oral hormonal contraceptives are used by approximately 151 million women of reproductive age.⁴⁰ The traditional approach is to avoid combined hormonal contraception (CHC) in patients who have migraine with aura because of its association with a two-fold increased risk of ischemic stroke. However, the studies that identified this increased risk of stroke were using older formulations of CHC which have much higher doses of estrogen than we have today. “Low dose” for example, often consisted of less than 50 mcg of estrogen, whereas today this would be considered a high dose of estrogen. Subsequent studies have identified an increased risk of stroke that correlates with increasing doses of estrogen. Many studies have consistently shown that pills containing less than or equal to 25 mcg of estrogen do not increase stroke risk in women with migraine, with or without aura. The greatest risk factors for stroke in the previously mentioned studies on CHC appear to be smoking and estrogen doses of 30 mcg or more. It should be noted that one large study found an increased stroke risk with increasing aura frequency in women over 45. Therefore, it is still important to ensure patients have no contraindications to CHC before prescribing. In general, a CHC prescription with estradiol doses of 25 mcg or less should not be withheld due to a diagnosis of migraine with or without aura since it has been shown to have increased benefits for this subpopulation of women when compared to other contraceptive options.²³ The benefits of low-dose CHC should also be considered. Low-dose continuous CHC can be used as a prophylactic measure for menstrual migraine, decreasing the total number of headache days and headache severity.²² Some studies show that eliminating the estrogen drop with continuous CHC can prevent menstrually-related migraine.²³

Discussion

It is evident epidemiologically that migraine pathogenesis has a strong hormonal contribution with presentation starting at menarche and often waning with menopause. When thinking about the treatment of migraine throughout a woman's life, several events that occur between menarche and menopause must be considered.

The first is a woman's monthly menstrual cycle. A small subset of women have pure menstrual migraine, and a majority have menstrually-related migraine.²¹ In relation to the menstrual cycle, days -2 to +3 tend to be the most troublesome due to decreasing estrogen levels, which can trigger migraine attacks.¹⁰ These menstrual migraine attacks, whether pure or menstrually-related, can be combated with a patient's normal acute migraine attack therapy or by prophylaxis with NSAIDs, triptans, or estradiol replacement.

The second is pregnancy. Women often see improvement in their migraine frequency during pregnancy.¹⁰ Some women may still need migraine treatment during pregnancy; however, understanding which migraine therapies are appropriate in pregnancy is important. Preventative options are beta-blockers, TCAs, and onabotulinumtoxinA. Acute options are acetaminophen, NSAIDs, and triptans. Caution should be advised with newer migraine medications that work by inhibiting CGRP. It is crucial to manage and treat migraine in pregnancy to help prevent adverse outcomes, as they can lead to negative consequences for both the mother and the baby.

The third category is a woman who desires hormonal contraception for pregnancy prevention, dysmenorrhea, or menorrhagia. Many women receive prescriptions for oral contraceptives, and migraine should be an important consideration in contraceptive choice. Low-dose continuous CHC has been shown to reduce migraine frequency and severity.²² This can also be a useful prophylactic method for women with menstrual migraine. Regardless, caution should be exercised when choosing hormonal contraception for women with migraine as estrogen drop-off can trigger migraine attacks.¹⁴

Clinicians must recognize that migraine can change throughout a woman's life, likely in conjunction with corresponding hormonal changes. Migraine attacks might increase in frequency or severity shortly after menarche or during the perimenopausal period. Planning for pregnancy might require a change in migraine treatment to an appropriate agent. After menopause has been completed, migraine therapy may no longer be necessary. The thorough physician will consider these stages for each patient and tailor their therapies accordingly.

Conclusion

The management of migraine is notably different from other chronic and disabling diseases which often present later in life. As the second leading cause of years lived with disability,¹ migraine is an extremely prevalent and pertinent condition in women of all ages that deserves proper diagnosis and treatment. It disproportionately affects women² and can change throughout their lives, requiring constant vigilance from the physician. It is of the utmost importance that physicians understand how and when migraine may change and what treatment strategies can be used to combat these fluctuations. With this better understanding, one can be hopeful that fewer women will be disabled throughout their lives due to their migraine disease.

Acknowledgments

D.E.D. has received compensation from the Carolina Headache Foundation for her work as Executive Director.

D.A.D. has received compensation from the Astellas Speakers Bureau, Abbvie Speakers Bureau, and for participation in a Teva Primary Care Board.

Submitted: March 30, 2024 CDT. Accepted: May 16, 2024 CDT. Published: May 16, 2024 CDT.

REFERENCES

1. GBD 2016 Headache Collaborators. Global, regional, and national burden of migraine and tension-type headache, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016 [published correction appears in *Lancet Neurol.* 2021 Dec;20(12):e7]. *Lancet Neurol.* 2018;17(11):954-976.
2. Smitherman TA, Burch R, Sheikh H, Loder E. The prevalence, impact, and treatment of migraine and severe headaches in the United States: a review of statistics from national surveillance studies. *Headache.* 2013;53(3):427-436. doi:[10.1111/head.12074](https://doi.org/10.1111/head.12074)
3. Pakalnis A. Migraine and hormones. *Semin Pediatr Neurol.* 2016;23(1):92-94. doi:[10.1016/j.spen.2016.01.005](https://doi.org/10.1016/j.spen.2016.01.005)
4. Miller S, Matharu MS. Migraine is underdiagnosed and undertreated. *Practitioner.* 2014;258(1774):19-3.
5. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition. *Cephalalgia.* 2018;38(1):1-211. doi:[10.1177/0333102417738202](https://doi.org/10.1177/0333102417738202)
6. Pietroben D, Moskowitz MA. Pathophysiology of migraine. *The Annual Review of Physiology.* 2013;75:365-391. doi:[10.1146/annurev-physiol-030212-183717](https://doi.org/10.1146/annurev-physiol-030212-183717)
7. Edvinsson L, Haanes KA, Warfvinge K, Krause DN. CGRP as the target of new migraine therapies — successful translation from bench to clinic. *Nature Reviews Neurology.* 2018;14(6):338-350. doi:[10.1038/s41582-018-0003-1](https://doi.org/10.1038/s41582-018-0003-1)
8. Bron C, Sutherland HG, Griffiths LR. Exploring the Hereditary Nature of Migraine. *Neuropsychiatric Disease and Treatment.* 2021;17:1183-1194. doi:[10.2147/NDT.S282562](https://doi.org/10.2147/NDT.S282562). PMID:33911866
9. Martin VT, Behbehani M. Ovarian hormones and migraine headache: understanding mechanisms and pathogenesis--part I. *Headache.* 2006;46(1):3-23. doi:[10.1111/j.1526-4610.2006.00309.x](https://doi.org/10.1111/j.1526-4610.2006.00309.x)
10. Sacco S, Ricci S, Degan D, Carolei A. Migraine in women: the role of hormones and their impact on vascular diseases. *J Headache Pain.* 2012;13(3):177-189. doi:[10.1007/s10194-012-0424-y](https://doi.org/10.1007/s10194-012-0424-y). PMID:22367631
11. Dalsgaard-Nielsen T, Engberg-Pedersen H, Holm HE. Clinical and statistical investigations of the epidemiology of migraine. *Dan Med Bull.* 1970;17(5):138-148.
12. Martin VT, Behbehani M. Ovarian hormones and migraine headache: understanding mechanisms and pathogenesis--part 2. *Headache.* 2006;46(3):365-386. doi:[10.1111/j.1526-4610.2006.00370.x](https://doi.org/10.1111/j.1526-4610.2006.00370.x)
13. Ursitti F, Valeriani M. Migraine in childhood: Gender differences. *Eur J Paediatr Neurol.* 2023;42:122-125. doi:[10.1016/j.ejpn.2023.01.002](https://doi.org/10.1016/j.ejpn.2023.01.002)
14. Chai NC, Peterlin BL, Calhoun AH. Migraine and estrogen. *Curr Opin Neurol.* 2014;27(3):315-324. doi:[10.1097/WCO.0000000000000091](https://doi.org/10.1097/WCO.0000000000000091). PMID:24792340
15. Al-Chalabi M, Bass AN, Alsalman I. Physiology, Prolactin. In: *StatPearls [Internet]*. StatPearls Publishing; 2024. <https://www.ncbi.nlm.nih.gov/books/NBK507829/>
16. Serva WAD, Serva VMSBD, De Fátima Costa Caminha M, Figueirôa JN, Serva GBD, Valência MM. Exclusive breastfeeding protects against postpartum migraine recurrence attacks? *Arquivos De Neuro-Psiquiatria.* 2012;70(6):428-434. doi:[10.1590/S0004-282X2012000600009](https://doi.org/10.1590/S0004-282X2012000600009)
17. Maggioni F, Alessi C, Maggino T, Zanchin G. Headache during pregnancy. *Cephalalgia.* 1997;17(7):765-769. doi:[10.1046/j.1468-2982.1997.1707765.x](https://doi.org/10.1046/j.1468-2982.1997.1707765.x)

18. Goadsby PJ, Goldberg J, Silberstein SD. Migraine in pregnancy. *BMJ*. 2008;336(7659):1502-1504. doi:[10.1136/bmj.39559.675891.AD](https://doi.org/10.1136/bmj.39559.675891.AD). PMID:18583683
19. Wang SJ, Fuh JL, Lu SR, Juang KD, Wang PH. Migraine prevalence during menopausal transition. *Headache*. 2003;43(5):470-478. doi:[10.1046/j.1526-4610.2003.03092.x](https://doi.org/10.1046/j.1526-4610.2003.03092.x)
20. Somerville BW. The role of estradiol withdrawal in the etiology of menstrual migraine. *Neurology*. 1972;22(4):355-365. doi:[10.1212/WNL.22.4.355](https://doi.org/10.1212/WNL.22.4.355)
21. MacGregor EA, Hackshaw A. Prevalence of migraine on each day of the natural menstrual cycle. *Neurology*. 2004;63(2):351-353. doi:[10.1212/01.WNL.0000133134.68143.2E](https://doi.org/10.1212/01.WNL.0000133134.68143.2E)
22. Macgregor EA. Menstrual migraine: therapeutic approaches [published correction appears in *Ther Adv Neurol Disord*. 2010 May;3(3):197-8]. *Ther Adv Neurol Disord*. 2009;2(5):327-336. doi:[10.1177/1756285609335537](https://doi.org/10.1177/1756285609335537). PMID:21180623
23. Calhoun AH. Hormonal Contraceptives and Migraine With Aura-Is There Still a Risk? *Headache*. 2017;57(2):184-193. doi:[10.1111/head.12960](https://doi.org/10.1111/head.12960)
24. Sullivan E, Bushnell C. Management of Menstrual Migraine: A Review of Current Abortive and Prophylactic Therapies. *Current Pain and Headache Reports*. 2010;14(5):376-384. doi:[10.1007/s11916-010-0138-2](https://doi.org/10.1007/s11916-010-0138-2). PMID:20697846
25. MacGregor EA. A review of frovatriptan for the treatment of menstrual migraine. *International Journal of Women's Health*. 2014;6:523-535. doi:[10.2147/IJWH.S63444](https://doi.org/10.2147/IJWH.S63444). PMID:24904224
26. Amundsen S, Nordeng H, Nezvalová-Henriksen K, Stovner LJ, Spigset O. Pharmacological treatment of migraine during pregnancy and breastfeeding. *Nat Rev Neurol*. 2015;11(4):209-219. doi:[10.1038/nrneurol.2015.29](https://doi.org/10.1038/nrneurol.2015.29)
27. Lee MJ, Guinn D, Hickenbottom S. UpToDate. www.uptodate.com. April 2, 2024. Accessed May 7, 2024. https://www.uptodate.com/contents/headache-during-pregnancy-and-postpartum?search=propranolol%20pregnancy&source=search_result&selectedTitle=7%7E148&sage_type=default&display_rank=6
28. Tepper D. Pregnancy and lactation--migraine management. *Headache*. 2015;55(4):607-608. doi:[10.1111/head.12540](https://doi.org/10.1111/head.12540)
29. Worthington I, Pringsheim T, Gawel MJ, et al. Canadian Headache Society Guideline: Acute Drug Therapy for Migraine Headache. *The Canadian Journal of Neurological Sciences*. 2013;40(S3):S1-S3. doi:[10.1017/S0317167100017819](https://doi.org/10.1017/S0317167100017819)
30. Fox AW. Revised estimate for probability of successful outcome of pregnancy after sumatriptan exposure [letter]. *Headache*. 2004;44:842-843. doi:[10.1111/j.1526-4610.2004.04158_6.x](https://doi.org/10.1111/j.1526-4610.2004.04158_6.x)
31. Cunnington M, Ephross S, Churchill P. The safety of sumatriptan and naratriptan in pregnancy: What have we learned? *Headache*. 2009;49:1414-1422.
32. Nezvalová-Henriksen K, Spigset O, Nordeng H. Triptan exposure during pregnancy and the risk of major congenital malformations and adverse pregnancy outcomes: results from the Norwegian Mother and Child Cohort Study. *Headache*. 2010;50(4):563-575. doi:[10.1111/j.1526-4610.2010.01619.x](https://doi.org/10.1111/j.1526-4610.2010.01619.x)
33. Fuseau E, Petricoul O, Moore KH, Barrow A, Ibbotson T. Clinical pharmacokinetics of intranasal sumatriptan. *Clin Pharmacokinet*. 2002;41(11):801-811. doi:[10.2165/00003088-200241110-00002](https://doi.org/10.2165/00003088-200241110-00002)
34. Schwedt T, Garza I. Preventive treatment of episodic migraine in adults. medilib.ir. September 25, 2023. Accessed May 7, 2024. <https://medilib.ir/uptodate/show/3345>

35. Headaches in Pregnancy and Postpartum. www.acog.org. May 2022. <https://www.acog.org/clinical/clinical-guidance/clinical-practice-guideline/articles/2022/05/headaches-in-pregnancy-and-postpartum>
36. Wells RE, Turner DP, Lee M, Bishop L, Strauss L. Managing migraine during pregnancy and lactation. *Curr Neurol Neurosci Rep*. 2016;16(4):40. doi:[10.1007/s11910-016-0634-9](https://doi.org/10.1007/s11910-016-0634-9)
37. Brin MF, Kirby RS, Slavotinek A, et al. Pregnancy Outcomes in Patients Exposed to OnabotulinumtoxinA Treatment: A Cumulative 29-Year Safety Update. *Neurology*. 2023;101(2):e103-e113. doi:[10.1212/WNL.0000000000207375](https://doi.org/10.1212/WNL.0000000000207375). PMID:37137724
38. Nosedà R, Bedussi F, Gobbi C, Ceschi A, Zecca C. Safety profile of monoclonal antibodies targeting the calcitonin gene-related peptide system in pregnancy: Updated analysis in Vigibase®. *Cephalalgia*. 2023;43(4):033310242311580-033310242311580. doi:[10.1177/03331024231158083](https://doi.org/10.1177/03331024231158083)
39. Purdue-Smithe AC, Stuart JJ, Farland LV, et al. Prepregnancy Migraine, Migraine Phenotype, and Risk of Adverse Pregnancy Outcomes. *Neurology*. 2023;100(14). doi:[10.1212/WNL.0000000000206831](https://doi.org/10.1212/WNL.0000000000206831). PMID:36657989
40. Haakenstad A, Angelino O, Irvine CMS, et al. Measuring contraceptive method mix, prevalence, and demand satisfied by age and marital status in 204 countries and territories, 1970-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2022;400(10348):295-327. doi:[10.1016/S0140-6736\(22\)00936-9](https://doi.org/10.1016/S0140-6736(22)00936-9). PMID:35871816