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Review

Safety and Risks of Antihypertensive Medications During Breastfeeding: A Review of Current Guidelines

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Abstract: Hypertension disorders of pregnancy affect almost 10% of pregnancies. Most hypertensive disorders associated with pregnancy, including chronic hypertension and gestational hypertension, often persist into the postpartum period. Thus, many breastfeeding mothers require ongoing antihypertensive treatment with antihypertensive medications while nursing. This highlights the importance of understanding the efficacy, safety, and potential adverse effects of antihypertensive therapy in breastfeeding mothers. Unfortunately, research in this area is limited, and references in clinical guidelines remain sparse. Our review aims to provide a comprehensive summary of the current knowledge on antihypertensive medications during breastfeeding, drawing from available research and evidence-based guidelines. This article discusses all groups of antihypertensive drugs, presenting societies' recommendations and available clinical data. Based on the available literature, calcium channel blockers (nifedipine as the first choice) and diuretics and beta-blockers (labetalol, metoprolol, propranolol) appear to be the drugs of choice. Our review highlights the need for further research to evaluate the long-term safety of antihypertensive medications during breastfeeding, improve clinical guidelines, and ensure optimal treatment for nursing mothers.

Keywords: arterial hypertension; breastfeeding; antihypertensive medications

1. Introduction

Hypertension (HT) disorders of pregnancy affect almost 10% of pregnancies worldwide and remain the leading cause of maternal, fetal, and neonatal morbidity and mortality [1]. According to all compared guidelines, hypertension in pregnancy is diagnosed when systolic blood pressure is ≥140 mmHg and/or diastolic blood pressure is ≥90 mmHg. The risks associated with arterial hypertension in pregnancy include: low birth weight, preterm birth, placental abruption and prolonged high-level of neonatal care [2,3]. HT during pregnancy is categorized into two main groups: chronic hypertension and hypertensive disorders of pregnancy, which include pregnancy-induced hypertension and pre-eclampsia [4].

Blood pressure typically drops immediately after delivery, but may rise again, reaching a peak around 3–6 days postpartum. Given the physiological changes in blood pressure during the postnatal period, it is important to maintain close monitoring and continue antihypertensive treatment during the first week postpartum to avoid unnecessary or overly aggressive treatment [4]. Most hypertensive disorders associated with pregnancy, including chronic hypertension and gestational hypertension,

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often persist into the postpartum period. As a result, many breastfeeding mothers will require ongoing treatment with antihypertensive medications while nursing. This highlights the need to better understand the efficacy, safety, and potential adverse effects of antihypertensive drugs in breastfeeding mothers. However, research in this area remains limited, and clinical guidelines on recommended medications are still scarce.

Our review aims to provide a comprehensive summary of the current knowledge on the use of antihypertensive medications during breastfeeding, drawing from available research and evidence-based guidelines, including: the 2023 European Society of Hypertension (ESH) Guidelines for the Management of Arterial Hypertension [5], the 2024 European Society of Cardiology (ESC) Guidelines for the management of elevated blood pressure and hypertension [6], the 2019 Position Statement of the Polish Society of Hypertension [7], Polish Cardiac Society and Polish Society of Gynecologists and Obstetricians on Management of hypertension in pregnancy (PTGiP) [4], the 2022 International Society for the Study of Hypertension in Pregnancy (ISSHP) Recommendations [8] and the 2023 Society of Obstetric Medicine of Australia and New Zealand (SOMANZ) Hypertension in Pregnancy Guideline [9]. We selected recommendations for this review paper based on their publication date and practical relevance. These recommendations have also been incorporated into the Polish national guidelines for managing hypertension during pregnancy [4].

2. Pharmacokinetics of Drugs in Breastfeeding

Drugs ingested by a lactating mother pass from maternal plasma into milk by passive diffusion. The extent of drug transfer is influenced by various physicochemical properties, including the drug's acid-base profile, its relative protein binding in plasma and milk, lipid solubility, and the composition of the milk itself [10]. Generally, the higher lipid solubility of a drug corresponds to greater concentrations in human milk [11].

Unfortunately, population-based evidence is still scarce on the safety of drugs during breastfeeding. In the absence of clinical lactation data, it may be possible to predict the passage of drugs into breast milk (M/P ratio) using only the physicochemical properties of the drug and milk characteristics. Many recent studies use physiologically-based pharmacokinetic modeling to predict drug exposures in mothers and infants [11,12].

In 2019, the US Food and Drug Administration (FDA) released a guidance document for pharmaceutical companies providing recommendations on how to address the potential impact of maternal drug exposure, including assessment of levels of the drug (and metabolite) appearing in breast milk, the potential effects on breastfeeding infants, and effects of the drug on milk production. While most medications transfer from the mother's bloodstream into breast milk, the amount ingested by the breastfeeding infant is typically minimal [13]. Risk assessment should consider not only the potential effects of the drug on the infant but also the significant benefits of breastfeeding, the risks posed by untreated maternal conditions, and the mother’s determination to continue breastfeeding.

3. Drugs Used to Treat Hypertension During Breastfeeding

Recommendations generally agree that most antihypertensive medications taken by breastfeeding mothers are transferred into breast milk, but usually in very low concentrations [Table 1].

The 2019 PTGiP Recommendations stress that breastfeeding should not be discouraged in women undergoing medical treatment for hypertension. Furthermore, the SOMANZ Guidelines note that there is insufficient evidence to determine whether single-agent therapy is superior to combination therapy for managing postpartum hypertension. Treatment decisions should be made collaboratively through a shared decision-making process involving breastfeeding patients and medical professionals. Antihypertensive drugs recommended for use during breastfeeding across

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various guidelines include calcium channel blockers, diuretics, alpha-methyldopa, ACE inhibitors, and beta-blockers.

Table 1. Safety of antihypertensive drugs during breastfeeding, according to compared Recommendations.

ESH (2023)	ESC (2024)	PTGiP (2019)	ISSHP (2022)	SOMANZ (2023)
Antihypertensive drugs taken by the nursing mother are excreted into breast milk, mostly in very low concentrations.	All blood pressure-lowering drugs are excreted into breast milk. Except for propranolol, atenolol, acebutolol, and nifedipine, most drugs are excreted in very low concentrations in breast milk.	Breastfeeding should not be discouraged in women with hypertension, including those on medical treatment. Although most antihypertensive drugs pass into human breast milk, their concentrations are usually much lower than in serum. Detailed information on the safety of medications in breastfeeding women (including their concentration in breast milk and infantile blood, as well as possible and reported adverse effects) can be found in the LactMed database.	Most antihypertensive agents are acceptable for use in breastfeeding. Up-to-date information can be obtained in LactMed.	Data on the breast milk transmission of the most commonly used agents remains sparse. There remains inadequate data to suggest the superiority of a single agent or group of agents in selecting antihypertensives for the management of hypertension in the postpartum period. The choice of antihypertensive (beta-blockers, methyldopa, hydralazine, nifedipine, enalapril, clonidine) should be made through a shared decision-making process, particularly in breastfeeding or lactating women.

ISSHP: International Society for the Study of Hypertension in Pregnancy; ESH: European Society of Hypertension; ESC: European Society of Cardiology; PTGiP: Polish Society of Gynecologists and Obstetricians; SOMANZ: Society of Obstetric Medicine Australian and New Zealand; BP: blood pressure; HT: hypertension.

3.1. Calcium Channel Blockers

According to the Lactation Database (LactMed), **nifedipine** is excreted into breast milk in small amounts, with no adverse effects noted in infants exposed to it through breastfeeding [14,15]. A study of 21 women taking a median dosage of 40 mg of nifedipine daily shows that the infants would receive an average daily dosage of 0.1% of their mother's weight-adjusted dosage in breast milk [16]. Furthermore, nifedipine can be used to treat painful nipple vasospasm in nursing mothers who do not respond to other measures [17,18]. All reviewed guidelines agree that nifedipine is safe for use during breastfeeding. According to the 2023 SOMANZ Guidelines, it is the most extensively studied calcium channel blocker in this context, with no adverse effects observed in breastfed infants.

Studies on **verapamil** excretion into breast milk show varying results, with the estimated infant dose (adjusted for maternal weight) ranging from 0.01% to 0.5% [19,20]. Verapamil is known to potentially cause hyperprolactinemia and galactorrhea, though the clinical significance of these effects in breastfeeding mothers remains unclear [21,22]. According to LactMed, verapamil is unlikely to cause adverse effects in breastfed infants, particularly those older than two months [23]. The ESH

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and ESC guidelines consider verapamil safe for use during breastfeeding. However, the PTGiP recommendations highlight contradictory data regarding its safety.

According to the Lactation Database (LactMed), no relevant published information is available on **diltiazem's** effects on lactation or breast milk [24]. Based on limited data, the amount of diltiazem ingested by the infant is small and is not expected to cause any adverse effects. According to one published study, an exclusively breastfed infant would receive a maximum of 0.9% of the maternal weight-adjusted dosage [25]. Therefore, diltiazem is recommended for use during breastfeeding in both the ESC and SOMANZ guidelines.

According to LactMed, limited data suggest that **amlodipine** levels in breast milk are typically low, and plasma levels in breastfed infants are undetectable [26]. Three published case reports of postpartum women taking amlodipine found no physical or neurological abnormalities in the development of their infants [26–28]. The PTGiP recommendations indicate that amlodipine can be considered for treating breastfeeding patients if extended-release nifedipine is unavailable.

Table 2. Comparison of the guidelines for the use of calcium channel blockers during breastfeeding.

ESH (2023)	ESC (2024)	PTGiP (2019)	ISSHP (2022)	SOMANZ (2023)
Considered compatible with breastfeeding: nifedipine, verapamil.	Considered safe with breastfeeding: diltiazem, nifedipine, verapamil.	Extended-release nifedipine: allowed in breastfeeding women Amlodipine: no data on the safety in breastfeeding women. Seems a reasonable choice if extended-release nifedipine is unavailable Verapamil: contradictory data on safety.	No information.	Commonly used calcium channel blockers in the postpartum period include: nifedipine, amlodipine, and occasionally, diltiazem. Nifedipine: most extensively investigated in this setting with published safety information suggesting the absence of infant adverse effects with the use of nifedipine in the lactating mother. Passes into breast milk in very small amounts.

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3.2. Diuretics

According to LactMed, low doses of **furosemide** (20 mg daily) do not suppress lactation. However, if higher doses are needed, an alternate drug may be preferred [29]. Two randomized, controlled trials comparing postpartum furosemide in low doses (20 mg daily) to placebo in women who had gestational hypertension and preeclampsia found no difference in patient-reported breastfeeding difficulties [30,31].

Similarly to furosemide, high doses of **hydrochlorothiazide** (above 50 mg daily) may reduce breast milk production [32]. The excretion of hydrochlorothiazide into breast milk appears to be low. One study found that an infant breastfed by a mother taking a 50 mg oral hydrochlorothiazide received approximately 2% of the mother's weight-adjusted daily dose [33]. Currently, there are no reports of adverse effects on infants from hydrochlorothiazide use during breastfeeding.

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Spironolactone appears to be safe for use during breastfeeding, as it is poorly excreted into breast milk. One study indicated that a nursing infant would receive about 0.2% of the mother's total daily dosage [34]. Additionally, it is unlikely that spironolactone alone would be potent enough to suppress lactation [35]. While spironolactone can cause gynecomastia, the risk is very low compared to other drugs [36]. Currently, there are no reported adverse effects associated with spironolactone use during breastfeeding.

The recommendations for hypertension treatment during pregnancy and breastfeeding analyzed in our study are inconsistent regarding the use of diuretics while breastfeeding [Table 3]. The SOMANZ Guidelines state that there is no clear evidence of harm when using diuretics during breastfeeding, and they can be considered when clinically indicated. However, the ESH and PTGiP guidelines caution that certain diuretics may reduce milk production based on the understanding that intense diuresis from high doses of diuretics (especially combined with fluid restriction and breast binding) can negatively affect lactation [37,38]. However, this statement is based on a publication indicating that diuretics may reduce milk production and are generally not the preferred choice for breastfeeding women [39]. Likewise, other studies suggest that high-dose diuretics can negatively impact maternal milk supply [40,41]. Furthermore, another publication cited in the ESC guidelines highlights the lack of sufficient human data on the effects of diuretic use during pregnancy [42].

Table 3. Comparison of the guidelines for the use of diuretics during breastfeeding.

ESH (2023)	ESC (2024)	PTGiP (2019)	ISSHP (2022)	SOMANZ (2023)
Not contraindicated. They may be associated with reduced milk production.	Considered safe with breastfeeding. Recommended: furosemide, hydrochlorothiazide, spironolactone.	Diuretics should not be used in breastfeeding women as they suppress lactation.	No information.	Diuretics reduce the rate of persistent postpartum hypertension with no obvious evidence of harm. Given the limitation in the data, there isn't enough evidence to support the routine use of diuretics in women with preeclampsia in the postpartum period. The use of loop diuretics can be considered when there are clinical indications for their use.

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3.3. Alpha-Methyldopa

According to LactMed, the amounts of alpha-methyldopa ingested by infants breastfed by mothers taking this medication are low and are not expected to cause any adverse effects [43]. A study involving three women treated with 500 mg doses of alpha-methyldopa during breastfeeding estimated that infants received less than 0.2% of the mother's total dosage [44].

Currently, no acute or long-term adverse effects of alpha-methyldopa use during breastfeeding have been reported. Alpha-methyldopa is consistently recommended as a safe and effective option during breastfeeding across all reviewed guidelines. However, the ESH (2023) and ESC (2024)

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guidelines emphasize the increased risk of postpartum depression associated with its use, which should be carefully considered when prescribing this medication [Table 4].

Table 4. Comparison of the guidelines for the use of alpha-methyldopa during breastfeeding.

ESH (2023)	ESC (2024)	PTGiP (2019)	ISSHP (2022)	SOMANZ (2023)
Compatible with breastfeeding. Not a drug of first choice because it increases the risk of postpartum depression.	Considered safe with breastfeeding.	Passes to human breast milk in small amounts. It may trigger or exacerbate postpartum depression, sedation, and orthostatic hypotonia.	Concerns that methyldopa might increase the risk of postnatal mental health problems are unsubstantiated.	There remains a paucity of data on adverse effects of methyldopa exposure in infants through breastmilk.

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3.4. Angiotensin-Converting Enzyme (ACE) Inhibitors

Several retrospective studies suggest that ACE inhibitors used during pregnancy may impair fetal kidney development [45–47]. However, the results remain inconclusive, and to date, abnormal kidney development has not been proven or reported in any infants exposed to ACE inhibitors through breast milk.

Because of the low levels of **enalapril** in breastmilk, amounts ingested by the infant are small and would not be expected to cause any adverse effects in breastfed infants [48]. According to one study, the estimated maximum intake of an exclusively breastfed infant would be about 0.16% of the maternal weight-adjusted dosage [49]. No adverse effects of enalapril use during breastfeeding have been reported thus far. However, a report published in 1989 showed decreased plasma protein levels in patients treated with enalapril during lactation [50].

A study of eleven mothers taking **captopril** while breastfeeding reported that a nursing infant's maximum daily dosage is less than 0.014% of the mother's weight-adjusted daily dosage [51]. The data on prolactin levels when using captopril are contradictory. One series of controlled studies with patients having prolactin-secreting tumors showed no effect of captopril on prolactin release [52]. However, in another study, one woman out of 12 subjects was unable to produce enough milk for the study while taking captopril 100 mg three times daily, despite having successfully breastfed for 6 months [8]. It is not known if this decrease was an effect of captopril.

The studies estimate that a breastfed infant would receive about 1.6% of the maternal weight-adjusted dosage of quinapril and 0.14% of the maternal weight-adjusted **benazepril** dosage [10,53]. No adverse outcomes from the use of **quinapril** and benazepril during breastfeeding have been reported thus far.

The compared recommendations provide conflicting information regarding the safety of taking ACE inhibitors while breastfeeding [Table 5]. The ESH (2023) guidelines recognize ACE inhibitors as compatible with breastfeeding, particularly for women with underlying cardiovascular or chronic kidney disease. The PTGiP (2019) guidelines consider ACE inhibitors contraindicated during pregnancy as they could affect fetal kidney development. This risk should be carefully considered when prescribing ACE inhibitors for hypertension in breastfeeding women, as ovulation can still occur during lactation, potentially leading to unintended pregnancy [54,55]. According to PTGiP recommendations, enalapril, captopril, and quinapril may be used in breastfeeding women with underlying heart failure or heart disease. Additionally, the ESC guidelines also consider benazepril a safe option.

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Table 5. Comparison of the guidelines for the use of ACE inhibitors during breastfeeding.

ESH (2023)	ESC (2024)	PTGiP (2019)	ISSHP (2022)	SOMANZ (2023)
Compatible with breastfeeding. It can be used in women with underlying cardiovascular disease or chronic kidney disease.	Considered safe with breastfeeding: benazepril, captopril, enalapril, quinapril.	Contraindicated in pregnancy, but as they pass to human breast milk in negligible amounts, some of them are approved for the treatment (enalapril, captopril, quinapril). Contraindicated in women who breastfeed preterm infants and infants with suspected kidney disease. There are special indications for using ACEi in breastfeeding women with heart failure and peripartum cardiomyopathy.	ACE inhibitors, including captopril, enalapril, and quinapril, are acceptable for use in breastfeeding.	There is a theoretical concern that ACE inhibitors could affect infant kidney development, particularly in infants with extreme prematurity. However, this remains inadequately investigated. Enalapril: milk levels were undetectable. Data on infant adverse events remain sparse.

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3.5. Beta-Blockers

Beta-blockers are among the drugs recommended for use by mothers with hypertension during the breastfeeding period. The excretion of beta-adrenergic blocking drugs into breast milk is largely determined by their protein binding. Those with low binding are more extensively excreted into breast milk. Accumulation of the drugs in the infant is related to the fraction excreted in urine [53].

According to LactMed, with 50% protein binding and 5% renal excretion, amounts of **labetalol** ingested by the infant are small and would not be expected to cause any adverse effects in full-term breastfed infants [56]. Reports show that intravenous labetalol can increase serum prolactin. This effect was not shown in women taking labetalol orally [57]. Thankfully, the maternal prolactin level in a mother with established lactation may not affect her ability to breastfeed. The reports on labetalol use in breastfeeding remain scarce. Some of the reported side effects in breastfed infants include: sinus bradycardia, prolonged QT and weak sucking, while maternal side effects were Raynaud's phenomenon and burning sensation of the nipples.

Metoprolol is characterized by 10% protein binding, 40% renal excretion, and a moderate half-life, presenting a moderately low risk for accumulation in infants [58]. Thus far, no reports showing adverse effects in breastfed infants or breastfeeding mothers were found [Table 4]. SOMANZ Guidelines mention a few case reports of infant bradycardia, but the results of the mentioned case reports were not statistically significant, and the beta-blocker used by breastfeeding mothers was not specified [59].

Propranolol presents a low risk for accumulation in infants, with 87% protein binding, less than 1% renal excretion, and a moderate half-life [60]. Studies on propanolol use during breastfeeding remain scarce. Some of the reported adverse effects in breastfed infants include sleepiness, bradycardia, and hypoglycemia, but the relevance and statistical significance of this data is questionable [Table 6]. Thus far, no adverse reactions in breastfeeding mothers clearly attributable to

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propranolol were found. However, a case series of mothers with persistent pain associated with breastfeeding shows that propranolol can be used successfully to reduce the symptoms [61].

According to LactMed, **nadolol** presents a high risk for accumulation in infants (25% protein binding, 70% renal excretion, and long half-life), and other beta-adrenergic blocking drugs should be chosen [62]. No relevant published information was found on the adverse effects of **timolol** use when breastfeeding. However, a prospective study on postpartum breastfeeding showed no adverse reactions in the breastfed infants of two mothers taking nadolol [63]. Timolol, with less than 10% protein binding, 20% renal excretion, and a relatively short half-life, presents a moderate risk for accumulation in infants [64]. No relevant published information was found on the adverse effects of timolol use for hypertension with breastfeeding. The only reports are on ophthalmic timolol drops use, and showed no adverse effects in breastfed newborns [65–67]. There are no mentions of **oxprenolol** use during breastfeeding in LactMed.

LactMed mentions that **nebivolol** and **carvedilol** are characterized by 98% protein binding and a relatively long half-life, presenting a moderate risk for accumulation in infants [68,69]. There is a report of a 2-day-old neonate admitted with persistent severe hypoglycemia and jaundice. The mother reported taking nebivolol 5 mg/day for unspecified tachycardia in the last 4 months of pregnancy. Clinical and instrumental investigations carried out during hospitalization did not reveal any congenital or perinatal abnormalities. After treatment for metabolic and electrolyte imbalance, he was discharged on the 10th day of hospitalization, in good clinical condition and with normalization of clinical and laboratory parameters [70].

The guideline comparison on the use of beta-blockers during breastfeeding is presented in Table 6.

Table 6. Comparison of the guidelines for the use of beta-blockers during breastfeeding.

ESH (2023)	ESC (2024)	PTGiP (2019)	ISSHP (2022)	SOMANZ (2023)
No information.	Considered safe with breastfeeding: labetalol, metoprolol, nadolol, oxprenolol, propranolol, timolol.	Pass to human breast milk in small amounts, although there are significant differences between the individual agents in this drug class. Metoprolol and labetalol are approved for use in breastfeeding women. Newer beta-blockers (nebivolol) and newer drugs with the mechanism of action identical to the one of labetalol (carvedilol) cannot be currently recommended in breastfeeding women due to lack of data.	No information.	Labetalol: moderately low risk for accumulation in infants, no reported infant adverse events. Metoprolol: moderately low risk for accumulation in infants, Whilst there have been a few case reports of infant bradycardia, there has not been a statistically significant difference in the rate of infant adverse events. Propranolol: a low risk for accumulation in infants, There remains a significant paucity in the literature on any infant adverse events with the use of Propranolol.

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Table 7. Side effects of beta-blockers use during breastfeeding.

DRUG	DRUG LEVELS IN BREASTFED INFANTS	REPORTED ADVERSE EFFECTS IN BREASTFED INFANTS	REPORTED ADVERSE EFFECTS IN BREASTFEEDING MOTHERS
LABETALOL	The average dose received by breastfed infants is estimated to be between 0.004% and 0.07% of the maternal dose [10].	Case Report: Sinus bradycardia: a 26-week premature infant, mother was taking 300 mg of labetalol twice daily [71]. Case Report: Prolonged QT: a 2-month-old infant, mother was taking 100 mg of labetalol twice daily [72]. Prospective study: Weak sucking: unreported dosage of labetalol [63].	Intravenous labetalol can increase serum prolactin, and oral labetalol does not increase serum prolactin [57]. Case Report: Raynaud's phenomenon of the nipples: a woman with history of symptoms of Raynaud's phenomenon, 100 mg of labetalol twice daily during breastfeeding after two pregnancies [73]. Case Report: Burning sensation of the nipples: intravenous labetalol for pre-eclampsia [74].
METOPROLOL	At a dose of 50-100mg daily, the average dose received by the breastfed infants is estimated to range from 0.005% and 0.01% of maternal dose [75].	Cohort Study: of 6 mothers taking metoprolol, none reported adverse effects in her breastfed infant [59]. Prospective Cohort Study: of 2 mothers taking metoprolol, none reported adverse effects in her breastfed infant [63].	No relevant published information was found.

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PROPRANOLOL	A fully breastfed infant would receive between <0.1 and 0.9% of the weight-adjusted maternal dosage of propranolol [76].	Prospective cohort study: of 8 mothers taking propranolol, one reported sleepiness in her breastfed infant. The data was not statistically significant, and the mother was taking other unspecified drugs for hypertension [59]. Case report: a case of bradycardia in a 2-day-old infant breastfed by a mother taking propranolol. It is not clear whether the mother had been taking propranolol near birth term and might have transmitted the drug to the infant transplacentally [63]. Prospective cohort study: of 16 mothers taking propranolol while breastfeeding, three women reported their infants' hypoglycemia, and one reported the infant's bradycardia [63].	No relevant published information was found.
NADOLOL	It is estimated that a fully breastfed infant would receive about 5.1% of the maternal weight-adjusted dosage of Nadolol [10].	No relevant published information was found.	No relevant published information was found.
TIMOLOL	It was estimated that a fully breastfed infant would receive between 0.96% to 1.2% of the maternal weight-adjusted dosage [77].	No relevant published information was found.	No relevant published information was found.
NEBIVOLOL	No relevant published information was found.	No relevant published information was found.	No relevant published information was found.
CARVEDILOL	No relevant published information was found.	No relevant published information was found.	No relevant published information was found.

3.6. Other Drugs Mentioned in the Recommendations

3.6.1. Clonidine

The mechanism of action of **clonidine** is caused by the stimulation of α2-adrenoreceptors of the inhibitory structures of the brain as well as a reduction of sympathetic impulses to the blood vessels and brain. The hypotensive action of clonidine is associated with a reduction of general peripheral vascular resistance, reduced frequency of cardiac beats, and a reduction of cardiac output [53].

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Typical side effects of clonidine include drowsiness, dizziness, constipation, headaches, and xerostomia.

A study from 1987 on 9 nursing women taking oral clonidine shows that an exclusively breastfed infant would receive an estimated 4.1 to 8.4% of the maternal weight-adjusted dosage, which represents an average of about 50% of the simultaneous maternal serum levels. [78]. Despite the infant's high serum levels of clonidine, no typical side effects were reported in this study.

Another study, including an infant breastfed by a mother taking 0.15 mg of clonidine daily, reported drowsiness, hypotonia, suspected generalized seizures, and apnea in the first days of the infant's life. When breastfeeding was stopped, all symptoms were resolved within 24 hours [79]. Furthermore, clonidine has dose-related effects on both oxytocin and prolactin secretion. The effect of the drug on nursing mothers has not yet been well studied, but there is a case report of clonidine-induced postpartum galactorrhea [80].

According to LactMed, due to the high serum levels found in some breastfed infants, possible infant side effects, and the potential negative effects on lactation, other antihypertensive agents are preferred, especially while nursing a newborn or preterm infant [81].

According to ESC (2024) and SOMANZ (2023) Guidelines, clonidine might be considered a safe drug in the treatment of hypertension during breastfeeding [Table 8].

3.6.2. Hydralazine

Hydralazine is a vasodilator that is thought to reduce peripheral resistance directly by relaxing the smooth muscle cell layer in arterial vessels. The precise mechanism of action remains unknown but potentially involves an altered Ca^{2+} balance in vascular smooth muscle cells [82]. Some of the more common side effects of hydralazine use include: arm, back, or jaw pain, chest discomfort or tightness, irregular heartbeat, and shortness of breath.

Limited milk levels of hydralazine in breastfeeding mothers and its long history of use postpartum indicate that hydralazine is an acceptable antihypertensive for nursing mothers [83]. Furthermore, no adverse effects of hydralazine use during breastfeeding have been reported thus far.

3.6.3. Minoxidil

Minoxidil is a widely recognized pharmacological agent commonly used in the management of hair loss and hypertension. Its vasodilatory effect is primarily mediated by the activation of potassium channels in smooth muscle cells, resulting in hyperpolarization of the cell membrane. This hyperpolarization inhibits the influx of calcium ions, which are crucial for muscle contraction. Consequently, the relaxation and dilation of blood vessels occur, leading to a reduction in blood pressure [84]. Some of the most common side effects of minoxidil use include: irregular heartbeat, weight gain, flushing, swelling of lower legs, and increased hair growth.

According to LactMed, due to the limited information available on the use of oral minoxidil, the drug should be used with caution, especially when the therapy involves a high maternal dosage [85]. Currently, no relevant information has been published on the side effects of oral minoxidil use. However, a case report of a mother using 5% minoxidil topically twice a day during breastfeeding noted the development of considerable black hair on the infant's forehead at 2 months of age [86].

3.6.4. Angiotensin Receptor Blockers (ARBs)

Some of the most common ARBs used to treat hypertension include **irbesartan** and **losartan**. According to LactMed, both of those drugs are not recommended for breastfeeding mothers due to a lack of information on their use during breastfeeding [87,88]. The ESH (2023) recommendations confirm that ARBs are not recommended in the treatment of hypertension during breastfeeding due to limited safety evidence.

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Table 8. Comparison of the guidelines for the use of other drugs during breastfeeding.

ESH (2023)	ESC (2024)	PTGiP (2019)	ISSHP (2022)	SOMANZ (2023)
ARBs are not currently recommended (limited safety evidence).	Considered safe with breastfeeding: clonidine, hydralazine, minoxidil.	No information	No information	Hydralazine: lack of infant adverse effects reported in the literature.

ISSHP: International Society for the Study of Hypertension in Pregnancy; ESH: European Society of Hypertension; ESC: European Society of Cardiology; PTGiP: Polish Society of Gynecologists and Obstetricians; SOMANZ: Society of Obstetric Medicine Australian and New Zealand; BP: blood pressure; HT: hypertension.

4. Summary

A considerable number of breastfeeding mothers require antihypertensive therapy, which is often a continuation of treatment initiated before or during pregnancy. It is well established that most antihypertensive drugs taken by nursing mothers pass into breast milk, though usually in minimal amounts. Therefore, when selecting an appropriate antihypertensive medication during lactation, it is essential to consider all the safety aspects discussed in this article carefully.

Nifedipine and **amlodipine** are considered the safest calcium channel blockers for use during breastfeeding, whereas **diltiazem** and **verapamil** are not recommended. **Diuretics** may be prescribed only at low doses to minimize the risk of lactation suppression. Caution is advised when prescribing **alpha-methyldopa**, as it may increase the risk of postpartum depression. The use of **ACE inhibitors** should be approached carefully, as they may lead to fetal kidney abnormalities. Overall, **beta-blockers** with low protein binding and shorter half-lives have a reduced risk of adverse effects during breastfeeding. **Hydralazine** is considered safe for treating hypertension during breastfeeding, with no reported adverse effects. Due to the limited information available on the use of oral **minoxidil**, it should be used with caution. **Clonidine** and **angiotensin receptor blockers** (**ARBs**) are not recommended for the treatment of hypertension during breastfeeding.

It is important to note that for patients using **methyldopa** during pregnancy, the drug should be gradually discontinued after delivery due to the risk of exacerbating depression. In contrast, **labetalol** and **calcium channel blockers** used during pregnancy can be safely continued postpartum. Similarly, if cardioselective **beta-blockers** are indicated, **metoprolol** can be safely used before, during, and after pregnancy. The fact that these medications do not need to be stopped after pregnancy, unlike **methyldopa**, suggests they may be preferred for women who are planning or already pregnant.

Ongoing research and more comprehensive studies are needed to further assess the safety and long-term outcomes of these treatments. Until more conclusive data is available, clinicians should continue to weigh the risks and benefits of antihypertensive therapy on a case-by-case basis for breastfeeding mothers.

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