



HIGHLIGHTS OF PRESCRIBING INFORMATION
These highlights do not include all the information needed to use **PHENYLEPHRINE HYDROCHLORIDE INJECTION** safely and effectively. See full prescribing information for **PHENYLEPHRINE HYDROCHLORIDE INJECTION**.

PHENYLEPHRINE HYDROCHLORIDE injection, for intravenous use
Initial U.S. Approval: 1954

INDICATIONS AND USAGE
Phenylephrine hydrochloride injection is an alpha-1 adrenergic receptor agonist indicated for the treatment of clinically important hypotension resulting primarily from vasodilation in the setting of anesthesia. (1)

DOSAGE AND ADMINISTRATION
• Phenylephrine hydrochloride injection 500 mcg/5 mL (100 mcg/mL) **MUST NOT BE DILUTED** before administration as an intravenous bolus. It is supplied as a **READY-TO-USE** formulation. (2)

Dosing for treatment of hypotension during anesthesia
• Bolus intravenous injection: Initial dose is 40 mcg to 100 mcg. Additional boluses up to 200 mcg may be administered every 1 to 2 minutes as needed. (2)
• Adjust the dose according to the pressor response (i.e., titrate to effect). (2)

DOSAGE FORMS AND STRENGTHS
• Phenylephrine hydrochloride injection 500 mcg/5 mL (100 mcg/mL): 5 mL Single-dose ampule containing 5 mL of solution for injection corresponding to 0.5 mg of phenylephrine hydrochloride per ampule. (3)

CONTRAINDICATIONS
None (4)

WARNINGS AND PRECAUTIONS
Exacerbation of Angina, Heart Failure, or Pulmonary Arterial Hypertension: Phenylephrine hydrochloride injection can precipitate angina in patients with severe arteriosclerosis or history of angina, exacerbate underlying heart failure, and increase pulmonary arterial pressure. (5.1)
Peripheral and Visceral Ischemia: Phenylephrine hydrochloride injection can cause excessive peripheral and visceral vasoconstriction and ischemia to vital organs. (5.2)
Skin and Subcutaneous Necrosis: Extravasation during intravenous administration may cause necrosis or sloughing of tissue. (5.3)
Bradycardia: Phenylephrine hydrochloride injection can cause severe bradycardia and decreased cardiac output. (5.4)

ADVERSE REACTIONS
Most common adverse reactions during treatment: nausea, vomiting, and headache. (6)

To report SUSPECTED ADVERSE REACTIONS, contact Somerset Therapeutics, LLC at 1-800-417-9175 or FDA at 1-800-FDA-1088 or www.fda.gov/medwatch.

DRUG INTERACTIONS
Agonistic Effects (increase in phenylephrine hydrochloride injection blood pressure effect) can occur with monoamine oxidase inhibitors (MAOI), oxytocin and oxytocic drugs, tricyclic antidepressants, angiotensin and aldosterone, atropine, steroids, norepinephrine transporter inhibitors, ergot alkaloids. (7.1)
Antagonistic Effects (decrease in phenylephrine hydrochloride injection blood pressure effect) can occur with α-adrenergic antagonists, phosphodiesterase Type 5 inhibitors, mixed α- and β-receptor antagonists, calcium channel blockers, benzodiazepines and ACE inhibitors, centrally acting sympatholytic agents. (7.2)

See 17 for **PATIENT COUNSELING INFORMATION**

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FULL PRESCRIBING INFORMATION

1 INDICATIONS AND USAGE
Phenylephrine hydrochloride injection is indicated for the treatment of clinically important hypotension resulting primarily from vasodilation in the setting of anesthesia.

2 DOSAGE AND ADMINISTRATION
2.1 General Dosage and Administration Instructions
During Phenylephrine hydrochloride injection administration:

- Correct intravascular volume depletion.
- Correct acidosis. Acidosis may reduce the effectiveness of phenylephrine.

Parenteral drug products should be inspected visually for particulate matter and discoloration prior to administration. Do not use if the solution is colored or cloudy, or if it contains particulate matter. Discard any unused portion.

Administration Instructions for Phenylephrine Hydrochloride Injection, 500 mcg/5 mL (100 mcg/mL):
Phenylephrine Hydrochloride Injection, 500 mcg/5 mL (100 mcg/mL) **MUST NOT BE DILUTED** before administration as an intravenous bolus. It is supplied as **READY-TO-USE** formulation.

2.2 Dosing for Treatment of Hypotension during Anesthesia
The following are the recommended dosages for the treatment of hypotension during anesthesia.

Phenylephrine Hydrochloride Injection, 500 mcg/5 mL (100 mcg/mL):

- The recommended initial dose is 40 mcg to 100 mcg administered by intravenous bolus. Additional boluses up to 200 mcg may be administered every 1 to 2 minutes as needed.
- Adjust dosage according to the blood pressure goal.

3 DOSAGE FORMS AND STRENGTHS
Ampule
Phenylephrine hydrochloride injection USP, 500 mcg/5 mL (100 mcg/mL), for intravenous use, is a clear and colorless solution available in a type I clear ampule white snap off and blue band, 5 mL single-dose ampule containing 5 mL of solution for injection, corresponding to 0.5 mg of phenylephrine hydrochloride per ampule, (equivalent to 0.41 mg of phenylephrine base).

4 CONTRAINDICATIONS
None

5 WARNINGS AND PRECAUTIONS
5.1 Exacerbation of Angina, Heart Failure, or Pulmonary Arterial Hypertension
Because of its increasing blood pressure effects, phenylephrine hydrochloride injection can precipitate angina in patients with severe arteriosclerosis or history of angina, exacerbate underlying heart failure, and increase pulmonary arterial pressure.

5.2 Peripheral and Visceral Ischemia
Phenylephrine hydrochloride injection can cause excessive peripheral and visceral vasoconstriction and ischemia to vital organs, particularly in patients with extensive peripheral vascular disease.

5.3 Skin and Subcutaneous Necrosis
Extravasation of phenylephrine hydrochloride injection can cause necrosis or sloughing of tissue. Avoid extravasation by checking infusion site for free flow.

5.4 Bradycardia
Phenylephrine hydrochloride injection can cause severe bradycardia and decreased cardiac output.

5.5 Renal Toxicity
Phenylephrine hydrochloride injection can increase the need for renal replacement therapy in patients with septic shock. Monitor renal function.

5.6 Risk of Augmented Pressor Affect in Patients with Autonomic Dysfunction
The increasing blood pressure response to adrenergic drugs, including phenylephrine hydrochloride injection, can be increased in patients with autonomic dysfunction, as may occur with spinal cord injuries.

5.7 Pressor Effect with Concomitant Oxytocic Drugs
Oxytocic drugs potentiate the increasing blood pressure effect of sympathomimetic pressor amines including phenylephrine hydrochloride injection [see *Drug Interactions* (7.1)], with the potential for hemorrhagic stroke.

6 ADVERSE REACTIONS
Adverse reactions to phenylephrine hydrochloride injection are primarily attributable to excessive pharmacologic activity. Adverse reactions reported in published clinical studies, observational trials, and case reports of phenylephrine hydrochloride injection are listed below by body system. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to estimate their frequency reliably or to establish a causal relationship to drug exposure.

Cardiac disorders: Reflex bradycardia, lowered cardiac output, ischemia, hypertension, arrhythmias
Gastrointestinal disorders: Epigastric pain, vomiting, nausea
Nervous system disorders: Headache, blurred vision, neck pain, tremors
Vascular disorders: Hypertensive crisis
Respiratory, Thoracic and Mediastinal Disorders: Dyspnea
Skin and subcutaneous tissue disorders: Pruritis

7 DRUG INTERACTIONS
7.1 Interactions that Augment the Pressor Effect
The increasing blood pressure effect of phenylephrine hydrochloride injection is increased in patients receiving:

- Monoamine oxidase inhibitors (MAOI)
- Oxytocin and oxytocic drugs
- Tricyclic antidepressants
- Angiotensin, aldosterone
- Atropine
- Steroids, such as hydrocortisone
- Norepinephrine transporter inhibitors, such as atomoxetine
- Ergot alkaloids, such as methylergonovine maleate

7.2 Interactions that Antagonize the Pressor Effect
The increasing blood pressure effect of phenylephrine hydrochloride injection is decreased in patients receiving:

- α-adrenergic antagonists
- Phosphodiesterase Type 5 inhibitors
- Mixed α- and β-receptor antagonists
- Calcium channel blockers, such as nifedipine
- Benzodiazepines
- ACE inhibitors
- Centrally acting sympatholytic agents, such as reserpine, guanfacine

8 USE IN SPECIFIC POPULATIONS
8.1 Pregnancy
Risk Summary
Data from randomized controlled trials and meta-analyses with phenylephrine hydrochloride injection use in pregnant women during caesarean section have not established a drug-associated risk of major birth defects and miscarriage. These studies have not identified an adverse effect on maternal outcomes or infant Apgar scores [see *Data*]. There are no data on the use of phenylephrine during the first or second trimester. In animal reproduction and development studies in normotensive animals, evidence of fetal malformations was noted when phenylephrine was administered during organogenesis via a 1-hour infusion at 1.2 times the human daily dose (HDD) of 10 mg/60 kg/day. Decreased pup weights were noted in offspring of pregnant rats treated with 2.9 times the HDD [See *Data*].

The estimated background risk of major birth defects and miscarriage for the indicated population is unknown. All pregnancies have a background risk of birth defect, loss,

or other adverse outcomes. In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2-4% and 15-20%, respectively.

Clinical Considerations

Disease-Associated Maternal and/or Embryofetal Risk

Untreated hypotension associated with spinal anesthesia for cesarean section is associated with an increase in maternal nausea and vomiting. A sustained decrease in uterine blood flow due to maternal hypotension may result in fetal bradycardia and acidosis.

Data

Human Data

Published randomized controlled trials over several decades, which compared the use of phenylephrine injection to other similar agents in pregnant women during cesarean section, have not identified adverse maternal or infant outcomes. At recommended doses, phenylephrine does not appear to affect fetal heart rate or fetal heart variability to a significant degree.

There are no studies on the safety of phenylephrine injection exposure during the period of organogenesis, and therefore, it is not possible to draw any conclusions on the risk of birth defects following exposure to phenylephrine injection during pregnancy. In addition, there are no data on the risk of miscarriage following fetal exposure to phenylephrine injection.

Animal Data

No clear malformations or fetal toxicity were reported when normotensive pregnant rabbits were treated with phenylephrine via continuous intravenous infusion over 1 hour (0.5 mg/kg/day; approximately equivalent to a HDD based on body surface area) from Gestation Day 7 to 19. At this dose, which demonstrated no maternal toxicity, there was evidence of developmental delay (altered ossification of sternebra).

In a non-GLP dose range-finding study in normotensive pregnant rabbits, fetal lethality and cranial, paw, and limb malformations were noted following treatment with 1.2 mg/kg/day of phenylephrine via continuous intravenous infusion over 1 hour (2.3-times the HDD). This dose was clearly maternally toxic (increased mortality and significant body weight loss). An increase in the incidence of limb malformation (hyperextension of the forepaw) coincident with high fetal mortality was noted in a single litter at 0.6 mg/kg/day (1.2-times the HDD) in the absence of maternal toxicity.

No malformations or embryo-fetal toxicity were reported when normotensive pregnant rats were treated with up to 3 mg/kg/day phenylephrine via continuous intravenous infusion over 1 hour (2.9-times the HDD) from Gestation Day 6 to 17. This dose was associated with some maternal toxicity (decreased food consumption and body weights).

Decreased pup weights were reported in a pre- and postnatal development toxicity study in which normotensive pregnant rats were administered phenylephrine via continuous intravenous infusion over 1 hour (0.3, 1.0, or 3.0 mg/kg/day; 0.29, 1, or 2.9 times the HDD) from Gestation Day 6 through Lactation Day 21). No adverse effects on growth and development (learning and memory, sexual development, and fertility) were noted in the offspring of pregnant rats at any dose tested. Maternal toxicities (mortality late in gestation and during lactation period, decreased food consumption and body weight) occurred at 1 and 3 mg/kg/day of phenylephrine (equivalent to and 2.9 times the HDD, respectively).

8.2 Lactation

Risk Summary

There are no data on the presence of phenylephrine hydrochloride injection or its metabolite in human or animal milk, the effects on the breastfed infant, or the effects on milk production. The developmental and health benefits of breastfeeding should be considered along with the mother’s clinical need for phenylephrine hydrochloride injection and any potential adverse effects on the breastfed infant from phenylephrine hydrochloride injection or from the underlying maternal condition.

8.4 Pediatric Use

Safety and effectiveness in pediatric patients have not been established.

8.5 Geriatric Use

Clinical studies of phenylephrine did not include sufficient numbers of subjects aged 65 and over to determine whether they respond differently from younger subjects. Other reported clinical experience has not identified differences in responses between the elderly and younger patients. In general, dose selection for an elderly patient should be cautious, usually starting at the low end of the dosing range, reflecting the greater frequency of decreased hepatic, renal, or cardiac function, and of concomitant disease or other drug therapy.

8.6 Hepatic Impairment

In patients with liver cirrhosis [Child Pugh Class B and Class C], dose-response data indicate decreased responsiveness to phenylephrine. Start dosing in the recommended dose range but more phenylephrine may be needed in this population.

8.7 Renal Impairment

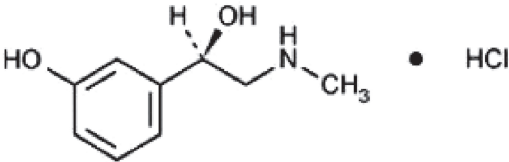
In patients with end stage renal disease (ESRD), dose-response data indicate increased responsiveness to phenylephrine. Consider starting at the lower end of the recommended dose range, and adjusting dose based on the target blood pressure goal.

10 OVERDOSAGE

Overdose of phenylephrine hydrochloride injection (phenylephrine hydrochloride) can cause a rapid rise in blood pressure. Symptoms of overdose include headache, vomiting, hypertension, reflex bradycardia, a sensation of fullness in the head, tingling of the extremities, and cardiac arrhythmias including ventricular extrasystoles and ventricular tachycardia.

11 DESCRIPTION

Phenylephrine is an alpha-1 adrenergic receptor agonist. The chemical name of phenylephrine hydrochloride is (-)-*m*-hydroxy-α-[(methylamino) methyl] benzyl alcohol hydrochloride, its molecular formula is C₉H₁₃NO₂ · HCl (Molecular Weight: 203.67 g/mol) and its structural formula is depicted below:



Phenylephrine hydrochloride is soluble in water and ethanol, and insoluble in chloroform and ethyl ether.

Phenylephrine hydrochloride injection, 500 mcg/5 mL (100 mcg/mL):

Phenylephrine hydrochloride injection, 500 mcg/5 mL (100 mcg/mL), is a sterile, nonpyrogenic, clear and colorless solution for intravenous use. It **MUST NOT BE DILUTED** before administration as an intravenous bolus.

Each mL contains: phenylephrine hydrochloride 100 mcg (equivalent to 80 mcg of phenylephrine base), sodium chloride 9.0 mg in water for injection. The pH is adjusted with hydrochloric acid if necessary. The pH range is 3.0 to 5.0.

12 CLINICAL PHARMACOLOGY

12.1 Mechanism of Action

Phenylephrine hydrochloride is an α-1 adrenergic receptor agonist.

12.2 Pharmacodynamics

Interaction of phenylephrine with α-1 adrenergic receptors on vascular smooth muscle cells causes activation of the cells and results in vasoconstriction. Following phenylephrine hydrochloride intravenous administration, increases in systolic and diastolic blood pressures, mean arterial blood pressure, and total peripheral vascular resistance are observed. The onset of blood pressure increase following an intravenous bolus phenylephrine hydrochloride administration is rapid, typically within minutes. As blood pressure increases following intravenous administration, vagal activity also increases, resulting in reflex bradycardia. Phenylephrine has activity on most vascular beds, including renal, pulmonary, and splanchnic arteries.

12.3 Pharmacokinetics

Following an intravenous infusion of phenylephrine hydrochloride, the observed effective half-life was approximately 5 minutes. The steady-state volume of distribution of approximately 340 L suggests a high distribution into organs and peripheral tissues. The average total serum clearance is approximately 2100 mL/min. The observed phenylephrine plasma terminal elimination half-life was 2.5 hours.

Phenylephrine is metabolized primarily by monoamine oxidase and sulfotransferase. After intravenous administration of radiolabeled phenylephrine, approximately 80% of the total dose was eliminated within first 12 h; and approximately 86% of the total dose was recovered in the urine within 48 h.

The excreted unchanged parent drug was 16% of the total dose in the urine at 48 h post intravenous administration. There are two major metabolites, with approximately 57 and 8% of the total dose excreted as *m*-hydroxymandelic acid and sulfate conjugates, respectively. The metabolites are considered not pharmacologically active.

13 NONCLINICAL TOXICOLOGY

13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

Carcinogenesis: Long-term animal studies that evaluated the carcinogenic potential of orally administered phenylephrine hydrochloride in F344/N rats and B6C3F₁ mice were completed by the National Toxicology Program using the dietary route of administration. There was no evidence of carcinogenicity in mice administered approximately 270 mg/kg/day (131 times the human daily dose (HDD) of 10 mg/60 kg/day based on body surface area) or rats administered approximately 50 mg/kg/day (48 times the HDD).

Mutagenesis: Phenylephrine hydrochloride tested negative in the *in vitro* bacterial reverse mutation assay (*S. typhimurium* strains TA98, TA100, TA1535 and TA1537), the *in vitro* chromosomal aberrations assay, the *in vitro* sister chromatid exchange assay, and the *in vivo* rat micronucleus assay. Positive results were reported in only one of two replicates of the *in vitro* mouse lymphoma assay.

Impairment of Fertility: Phenylephrine did not impair mating, fertility, or reproductive outcome in normotensive male rats treated with 3 mg/kg/day phenylephrine via continuous intravenous infusion over 1 hour (2.9 times the HDD) for 28 days prior to mating and for a minimum of 63 days prior to sacrifice and female rats treated with the same dosing regimen for 14 days prior to mating and through Gestation Day 6. This dose was associated with increased mortality in both male and female rats and decreased body weight gain in treated males. There were decreased caudal sperm density and increased abnormal sperm reported in males treated with 3 mg/kg/day phenylephrine (2.9 times the HDD).

14 CLINICAL STUDIES

The evidence for the efficacy of phenylephrine hydrochloride injection, is derived from studies of phenylephrine hydrochloride in the published literature. The literature support includes 16 studies evaluating the use of intravenous phenylephrine to treat hypotension during anesthesia. The 16 studies include 9 studies where phenylephrine was used in low-risk (ASA 1 and 2) pregnant women undergoing neuraxial anesthesia during Cesarean delivery, 6 studies in non-obstetric surgery under general anesthesia, and 1 study in non-obstetric surgery under combined general and neuraxial anesthesia. Phenylephrine has been shown to raise systolic and mean blood pressure when administered either as a bolus dose or by continuous infusion following the development of hypotension during anesthesia.

16 HOW SUPPLIED/STORAGE AND HANDLING

Phenylephrine hydrochloride injection USP, 500 mcg/5 mL (100 mcg/mL) for intravenous use, is a clear colorless solution, essentially free from visible extraneous matter available in a clear glass ampule with white snap off and blue band and is supplied as follows:

NDC No.	Strength	How Supplied
NDC 70069-591-10	500 mcg/5 mL	10 ampules per carton
Pack of 10 '5 mL Single-Dose ampules'	(100 mcg/mL)	

Store phenylephrine hydrochloride injection USP, 500 mcg/5 mL (100 mcg/mL) at 20°C to 25°C (68°F to 77°F), excursions permitted to 15°C to 30°C (59°F to 86°F) [see USP Controlled Room Temperature].

Protect from light.

Discard any unused portion.

17 PATIENT COUNSELING INFORMATION

If applicable, inform patient, family member, or caregiver that certain medical conditions and medications might influence how phenylephrine hydrochloride injection works.

Manufactured for:

Somerset Therapeutics, LLC
Hollywood, FL 33024

Made in India

Code No.:KR/DRUGS/KTK/28/289/97

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ST-PHI11/P/XX

SOMERSET THERAPEUTICS PRIVATE LIMITED				ARTWORK APPROVAL FORM			
Product	Phenylephrine Hydrochloride Injection, USP 500 mcg/5 mL			Style:	NA		
Specification:	Printed on 40-45 GSM ITC Newsprint Paper Ink : <i>Siegwerk</i> (VEGA SPRINT PROCESS BLACK -60-922415-9) <i>Toyo</i> (TK ARIS BLACK) (Benzophenone free)			Colours:	<div>■</div> Black		
				Dimension:	Open : 140 x 416 mm (LxW) Folded: 40 x 52 mm		
Item Code	120XXXX	Remarks	NA	No of Folds: (only for PIL)	4 folds	Artwork Print Scaled to	NA
Prepared by PDD	Verified by FD	Approved by Regulatory Affairs	Checked by Packing	Checked by QA		Approved by QA	