

# VASOPRESSIN- vasopressin injection

## Amphastar Pharmaceuticals, Inc.

### HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use VASOPRESSIN INJECTION safely and effectively. See full prescribing information for VASOPRESSIN INJECTION.

VASOPRESSIN injection for intravenous use

Initial U.S. Approval: 2014

#### INDICATIONS AND USAGE

- Vasopressin Injection, USP is indicated to increase blood pressure in adults with vasodilatory shock who remain hypotensive despite fluids and catecholamines. (1)

#### DOSAGE AND ADMINISTRATION

- Dilute 20 units/mL, single dose vial contents with normal saline (0.9% sodium chloride) or 5% dextrose in water (D5W) to either 0.1 units/mL or 1 unit/mL for intravenous administration. Discard unused diluted solution after 18 hours at room temperature or 24 hours under refrigeration. (2.1)
- Post-cardiotomy shock: 0.03 to 0.1 units/minute (2.2)
- Septic shock: 0.01 to 0.07 units/minute (2.2)

#### DOSAGE FORMS AND STRENGTHS

- Injection: 20 units per mL in a single dose vial. To be used after dilution. (3)

#### CONTRAINDICATIONS

- Vasopressin Injection, USP 1 mL single dose vial is contraindicated in patients with known allergy or hypersensitivity to 8-L-arginine vasopressin or chlorobutanol. (4)

#### WARNINGS AND PRECAUTIONS

- Can worsen cardiac function. (5.1)
- Reversible diabetes insipidus (5.2)

#### ADVERSE REACTIONS

The most common adverse reactions include decreased cardiac output, bradycardia, tachyarrhythmias, hyponatremia and ischemia (coronary, mesenteric, skin, digital). (6)

To report SUSPECTED ADVERSE REACTIONS, contact Amphastar Pharmaceuticals, Inc. at 1-800-423-4136 or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch)

#### DRUG INTERACTIONS

- Pressor effects of catecholamines and Vasopressin Injection, USP are expected to be additive. (7.1)
- Indomethacin may prolong effects of Vasopressin Injection, USP. (7.2)
- Co-administration of ganglionic blockers or drugs causing SIADH may increase the pressor response. (7.3, 7.5)
- Co-administration of drugs causing diabetes insipidus may decrease the pressor response. (7.6)

#### USE IN SPECIFIC POPULATIONS

- Pregnancy:** May induce uterine contractions. (8.1)
- Pediatric Use:** Safety and effectiveness have not been established. (8.4)
- Geriatric Use:** No safety issues have been identified in older patients. (8.5)

Revised: 8/2022

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\* Sections or subsections omitted from the full prescribing information are not listed.

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## FULL PRESCRIBING INFORMATION

### 1 INDICATIONS AND USAGE

Vasopressin Injection, USP is indicated to increase blood pressure in adults with vasodilatory shock who remain hypotensive despite fluids and catecholamines.

### 2 DOSAGE AND ADMINISTRATION

#### 2.1 Preparation of Solution

Inspect parenteral drug products for particulate matter and discoloration prior to use, whenever solution and container permit.

Dilute Vasopressin Injection, USP in normal saline (0.9% sodium chloride) or 5% dextrose in water (D5W) prior to use for intravenous administration. Discard unused diluted solution after 18 hours at room temperature or 24 hours under refrigeration.

**Table 1 Preparation of diluted solutions**

Fluid restriction?	Final concentration	Mix	
		Vasopressin Injection, USP	Diluent
No	0.1 units/mL	2.5 mL (50 units)	500 mL
Yes	1 unit/mL	5 mL (100 units)	100 mL

#### 2.2 Administration

In general, titrate to the lowest dose compatible with a clinically acceptable response.

The recommended starting dose is:

*Post-cardiotomy shock:* 0.03 units/minute

*Septic Shock:* 0.01 units/minute

Tritate up by 0.005 units/minute at 10- to 15-minute intervals until the target blood pressure is reached. There are limited data for doses above 0.1 units/minute for post-cardiotomy shock and 0.07 units/minute for septic shock. Adverse reactions are expected to increase with higher doses.

After target blood pressure has been maintained for 8 hours without the use of catecholamines, taper vasopressin injection by 0.005 units/minute every hour as tolerated to maintain target blood pressure.

### **3 DOSAGE FORMS AND STRENGTHS**

Vasopressin Injection, USP is a clear, practically colorless solution for intravenous administration available as 20 units/mL in a single dose vial. To be used after dilution.

### **4 CONTRAINDICATIONS**

Vasopressin Injection, USP 1 mL single dose vial is contraindicated in patients with known allergy or hypersensitivity to 8-L-arginine vasopressin or chlorobutanol.

### **5 WARNINGS AND PRECAUTIONS**

#### **5.1 Worsening Cardiac Function**

A decrease in cardiac index may be observed with the use of Vasopressin Injection, USP.

#### **5.2 Reversible Diabetes Insipidus**

Patients may experience reversible diabetes insipidus, manifested by the development of polyuria, a dilute urine, and hypernatremia, after cessation of treatment with vasopressin. Monitor serum electrolytes, fluid status, and urine output after vasopressin discontinuation. Some patients may require readministration of vasopressin or administration of desmopressin to correct fluid and electrolyte shifts.

### **6 ADVERSE REACTIONS**

The following adverse reactions associated with the use of vasopressin were identified in the literature. Because these reactions are reported voluntarily from a population of uncertain size, it is not possible to estimate their frequency reliably or to establish a causal relationship to drug exposure.

Bleeding/lymphatic system disorders: Hemorrhagic shock, decreased platelets, intractable bleeding

Cardiac disorders: Right heart failure, atrial fibrillation, bradycardia, myocardial ischemia

Gastrointestinal disorders: Mesenteric ischemia

Hepatobiliary: Increased bilirubin levels

Renal/urinary disorders: Acute renal insufficiency

Vascular disorders: Distal limb ischemia

Metabolic: Hyponatremia

Skin: Ischemic lesions

#### **Postmarketing Experience**

Reversible diabetes insipidus [see *Warnings and Precautions* (5.2)].

### **7 DRUG INTERACTIONS**

#### **7.1 Catecholamines**

Use with *catecholamines* is expected to result in an additive effect on mean arterial blood pressure and other hemodynamic parameters. Hemodynamic monitoring is recommended; adjust the dose of vasopressin as needed.

## 7.2 Indomethacin

Use with *indomethacin* may prolong the effect of Vasopressin Injection, USP on cardiac index and systemic vascular resistance. Hemodynamic monitoring is recommended; adjust the dose of vasopressin as needed [see *Clinical Pharmacology (12.3)*].

## 7.3 Ganglionic Blocking Agents

Use with *ganglionic blocking* agents may increase the effect of Vasopressin Injection, USP on mean arterial blood pressure. Hemodynamic monitoring is recommended; adjust the dose of vasopressin as needed [see *Clinical Pharmacology (12.3)*].

## 7.4 Drugs Suspected of Causing SIADH

Use with *drugs suspected of causing SIADH* (e.g., SSRIs, tricyclic antidepressants, haloperidol, chlorpropamide, enalapril, methyldopa, pentamidine, vincristine, cyclophosphamide, ifosfamide, felbamate) may increase the pressor effect in addition to the antidiuretic effect of Vasopressin Injection, USP. Hemodynamic monitoring is recommended; adjust the dose of vasopressin as needed.

## 7.5 Drugs Suspected of Causing Diabetes Insipidus

Use with *drugs suspected of causing diabetes insipidus* (e.g., demeclocycline, lithium, foscarnet, clozapine) may decrease the pressor effect in addition to the antidiuretic effect of Vasopressin Injection, USP. Hemodynamic monitoring is recommended; adjust the dose of vasopressin as needed.

# 8 USE IN SPECIFIC POPULATIONS

## 8.1 Pregnancy

### Risk Summary

There are no available data on Vasopressin Injection, USP use in pregnant women to inform a drug associated risk of major birth defects, miscarriage, or adverse maternal or fetal outcomes. Animal reproduction studies have not been conducted with vasopressin.

### Clinical Considerations

*Dose adjustments during pregnancy and the postpartum period:* Because of increased clearance of vasopressin in the second and third trimester, the dose of Vasopressin Injection, USP may need to be increased [see *Dosage and Administration (2.2)* and *Clinical Pharmacology (12.3)*].

*Maternal adverse reactions:* Vasopressin Injection, USP may produce tonic uterine contractions that could threaten the continuation of pregnancy.

## 8.2 Lactation

There are no data on the presence of vasopressin injection in either human or animal milk, the effects on the breastfed infant, or the effects on milk production.

## 8.4 Pediatric Use

Safety and effectiveness of Vasopressin Injection, USP in pediatric patients with vasodilatory shock have not been established.

## 8.5 Geriatric Use

Clinical studies of vasopressin 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 [see *Warnings and Precautions (5)*, *Adverse Reactions (6)*, and *Clinical Pharmacology (12.3)*].

## 10 OVERDOSAGE

Overdosage with Vasopressin Injection, USP can be expected to manifest as consequences of vasoconstriction of various vascular beds (peripheral, mesenteric, and coronary) and as hyponatremia. In addition, overdosage may lead less commonly to ventricular tachyarrhythmias (including Torsade de Pointes), rhabdomyolysis, and non-specific gastrointestinal symptoms.

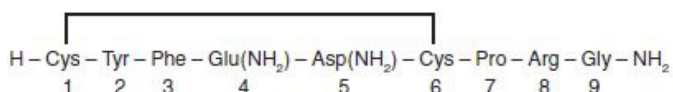
Direct effects will resolve within minutes of withdrawal of treatment.

## 11 DESCRIPTION

Vasopressin is a polypeptide hormone. Vasopressin Injection, USP is a sterile, aqueous solution of synthetic arginine vasopressin for intravenous administration.

The 1 mL solution contains vasopressin 20 units/mL, chlorobutanol, NF 0.5% as a preservative, and Water for Injection, USP adjusted with acetic acid to pH 3.4-3.6.

The chemical name of vasopressin is Cyclo (1-6) L-Cysteiny-L-Tyrosyl-L-Phenylalanyl-L-Glutaminy-L-Asparaginy-L-Cysteiny-L-Prolyl-L-Arginy-L-Glycinamide. It is a white to off-white amorphous powder, freely soluble in water. The structural formula is:



Molecular Formula: C<sub>46</sub>H<sub>65</sub>N<sub>15</sub>O<sub>12</sub>S<sub>2</sub>      Molecular Weight: 1084.23

One mg is equivalent to 530 units.

## 12 CLINICAL PHARMACOLOGY

### 12.1 Mechanism of Action

Vasopressin causes vasoconstriction by binding to V<sub>1</sub> receptors on vascular smooth muscle coupled to the Gq/11-phospholipase C-phosphatidyl-inositol-triphosphate pathway, resulting in the release of intracellular calcium. In addition, vasopressin stimulates antidiuresis via stimulation of V<sub>2</sub> receptors which are coupled to adenylyl cyclase.

### 12.2 Pharmacodynamics

At therapeutic doses exogenous vasopressin elicits a vasoconstrictive effect in most vascular beds including the splanchnic, renal and cutaneous circulation. In addition, vasopressin at pressor doses triggers contractions of smooth muscles in the gastrointestinal tract mediated by muscular V<sub>1</sub>-receptors and release of prolactin and ACTH via V<sub>3</sub> receptors. At lower concentrations typical for the antidiuretic hormone vasopressin inhibits water diuresis via renal V<sub>2</sub> receptors. In addition, vasopressin has been demonstrated to cause vasodilation in numerous vascular beds that are mediated by V<sub>2</sub>, V<sub>3</sub>, oxytocin and purinergic P2 receptors.

In patients with vasodilatory shock vasopressin in therapeutic doses increases systemic vascular resistance and mean arterial blood pressure and reduces the dose requirements for norepinephrine. Vasopressin tends to decrease heart rate and cardiac output. The pressor effect is proportional to the infusion rate of exogenous vasopressin. The pressor effect reaches its peak within 15 minutes. After stopping the infusion the pressor effect fades within 20 minutes. There is no evidence for tachyphylaxis or tolerance to the pressor effect of vasopressin in patients.

### 12.3 Pharmacokinetics

Vasopressin plasma concentrations increase linearly with increasing infusion rates from 10 to 200 µU/kg/min. Steady state plasma concentrations are achieved after 30 minutes of continuous intravenous infusion.

Distribution Vasopressin does not appear to bind plasma protein. The volume of

distribution is 140 mL/kg.

#### Elimination

At infusion rates used in vasodilatory shock (0.01 to 0.1 units/minute), the clearance of vasopressin is 9 to 25 mL/min/kg in patients with vasodilatory shock. The apparent  $t_{1/2}$  of vasopressin at these levels is  $\leq 10$  minutes.

#### Metabolism

Serine protease, carboxipeptidase and disulfide oxido-reductase cleave vasopressin at sites relevant for the pharmacological activity of the hormone. Thus, the generated metabolites are not expected to retain important pharmacological activity.

#### Excretion

Vasopressin is predominantly metabolized and only about 6% of the dose is excreted unchanged into urine.

#### Specific Populations

*Pregnancy:* Because of a spillover into blood of placental vasopressinase, the clearance of exogenous and endogenous vasopressin increases gradually over the course of a pregnancy. During the first trimester of pregnancy, the clearance is only slightly increased. However, by the third trimester the clearance of vasopressin is increased about 4-fold and at term up to 5-fold. After delivery, the clearance of vasopressin returns to preconception baseline within two weeks.

Drug Interactions Indomethacin more than doubles the time to offset for vasopressin's effect on peripheral vascular resistance and cardiac output in healthy subjects [see *Drug Interactions (7.2)*].

The ganglionic blocking agent tetra-ethylammonium increases the pressor effect of vasopressin by 20% in healthy subjects [see *Drug Interactions (7.3)*].

Halothane, morphine, fentanyl, alfentanil and sufentanil do not impact exposure to endogenous vasopressin.

## **13 NONCLINICAL TOXICOLOGY**

### **13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility**

No formal carcinogenicity or fertility studies with vasopressin have been conducted in animals. Vasopressin was found to be negative in the *in vitro* bacterial mutagenicity (Ames) test and the *in vitro* Chinese hamster ovary (CHO) cell chromosome aberration test. In mice, vasopressin has been reported to have an effect on function and fertilizing ability of spermatozoa.

### **13.2 Animal Toxicology and/or Pharmacology**

No toxicology studies were conducted with vasopressin.

## **14 CLINICAL STUDIES**

Increases in systolic and mean blood pressure following administration of vasopressin were observed in 7 studies in septic shock and 8 in post-cardiotomy vasodilatory shock.

## **16 HOW SUPPLIED/STORAGE AND HANDLING**

Vasopressin Injection, USP is a clear, practically colorless solution for intravenous administration available as:

A carton of 10 single dose vials. Each vial contains vasopressin 1 mL at 20 units/mL.

NDC 0548-9701-00 Stock No. 9701

Store between 2°C and 8°C (36°F and 46°F). Do not freeze.

Vials may be held up to 12 months upon removal from refrigeration to room temperature storage conditions (20°C to 25°C [68°F to 77°F], USP Controlled Room Temperature), anytime within the labeled shelf life. Once removed from refrigeration,

unopened vial should be marked to indicate the revised 12 month expiration date. If the manufacturer’s original expiration date is shorter than the revised expiration date, then the shorter date must be used. Do not use Vasopressin Injection, USP beyond the manufacturer’s expiration date stamped on the vial. The storage conditions and expiration periods are summarized in the following table.

	Unopened Refrigerated 2°C to 8°C (36°F to 46°F)	Unopened Room Temperature 20°C to 25°C (68°F to 77°F) Do not store above 25°C (77°F)	Opened (After First Puncture)
1 mL Vial	Until manufacturer expiration date	12 months or until manufacturer expiration date, whichever is earlier	N/A

Rx Only

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Amphastar Pharmaceuticals, Inc.  
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**PRINCIPAL DISPLAY PANEL TEXT - CARTON**

NDC 0548-9701-00 Rx Only

**Vasopressin  
Injection, USP**

**20 Units per mL**

**For Intravenous Infusion  
Must be diluted prior to use**

10 x 1 mL Single Dose Vials

5297016D/6-19

**Store between 2°C and 8°C (36°F and 46°F). Do not store above 25°C (77°F).  
Vials may be held at 20°C to 25°C (68°F to 77°F) for up to 12 months.**

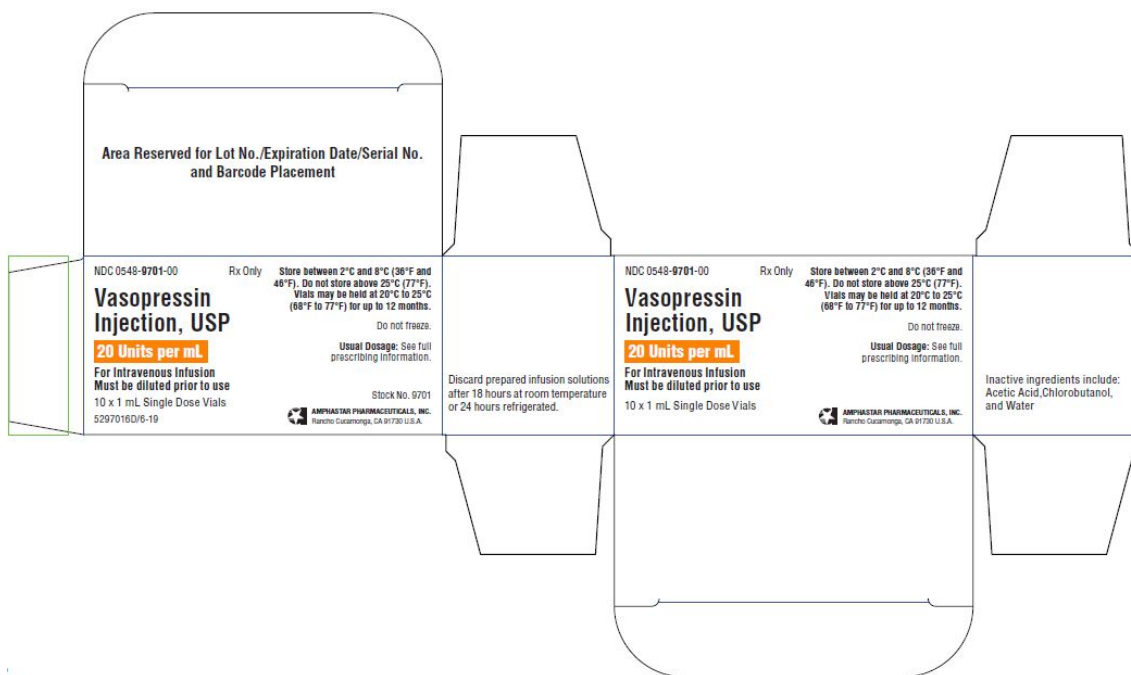
Do not freeze.

**Usual Dosage:** See full prescribing information.

Stock No. 9701

**AMPHASTAR PHARMACEUTICALS, INC.**

Rancho Cucamonga, CA 91730 U.S.A.



## VASOPRESSIN

vasopressin injection

### Product Information

<b>Product Type</b>	HUMAN PRESCRIPTION DRUG	<b>Item Code (Source)</b>	NDC:0548-9701
<b>Route of Administration</b>	INTRAVENOUS		

### Active Ingredient/Active Moiety

Ingredient Name	Basis of Strength	Strength
VASOPRESSIN (UNII: Y4907O6MFD) (ARGIPRESSIN - UNII:Y4907O6MFD)	VASOPRESSIN	20 [USP'U] in 1 mL

### Inactive Ingredients

Ingredient Name	Strength
CHLOROBUTANOL (UNII: HM4YQM8WRC)	
WATER (UNII: 059QF0K00R)	
ACETIC ACID (UNII: Q40Q9N063P)	

### Packaging

#	Item Code	Package Description	Marketing Start Date	Marketing End Date
1	NDC:0548-9701-00	1 in 1 CARTON	08/31/2022	
1		1 mL in 1 VIAL; Type 0: Not a Combination Product		

### Marketing Information

Marketing Category	Application Number or Monograph Citation	Marketing Start Date	Marketing End Date
ANDA	ANDA211857	08/22/2022	

**Labeler** - Amphastar Pharmaceuticals, Inc. (024736733)



## Establishment

Name	Address	ID/FEI	Business Operations
Amphastar Pharmaceuticals, Inc.		024736733	manufacture(0548-9701) , analysis(0548-9701)

Revised: 8/2022

Amphastar Pharmaceuticals, Inc.