Vasostrict® (vasopressin injection, USP) For Intravenous Injection

HIGHLIGHTS OF PRESCRIBING INFORMATION

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

VASOSTRICT® (vasopressin injection) for intravenous use
Initial U.S. Approval: 2014

INDICATIONS AND USAGE
• Vasostrict® is indicated to increase blood pressure in adults with vasodilatory shock (e.g., post-cardiotomy or sepsis) who remain hypotensive despite fluids and catecholamines. (1)

DOSE AND ADMINISTRATION
• Dilute Vasostrict® with normal saline (0.9% sodium chloride) or 5% dextrose in water (DSW) 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)

DOSE FORMS AND STRENGTHS
• Injection: 20 units per mL (3)

CONTRAINDICATIONS
• Vasostrict® 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)

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 Par Pharmaceutical at 1-800-828-9393 or FDA at 1-800-FDA-1088 or www.fda.gov/medwatch.

DRUG INTERACTIONS
• Pressor effects of catecholamines and Vasostrict® are expected to be additive. (7.1)
• Co-administration of ganglionic blockers or drugs causing SIADH may increase the pressor response. (7.3, 7.5)

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: 12/2016

FULL PRESCRIBING INFORMATION: CONTENTS*
1 INDICATIONS AND USAGE
2 DOSAGE AND ADMINISTRATION
  2.1 Preparation of Diluted Solutions
  2.2 Administration
3 DOSAGE FORMS AND STRENGTHS
4 CONTRAINDICATIONS
5 WARNINGS AND PRECAUTIONS
  5.1 Worsening Cardiac Function
6 ADVERSE REACTIONS
7 DRUG INTERACTIONS
  7.1 Catecholamines
  7.2 Indomethacin
  7.3 Ganglionic Blocking Agents
  7.4 Furosemide
  7.5 Drugs Suspected of Causing SIADH
  7.6 Drugs Suspected of Fainting
8 USE IN SPECIFIC POPULATIONS
  8.1 Pregnancy
  8.3 Nursing Mothers
  8.4 Pediatric Use
  8.5 Geriatric Use
10 OVERDOSAGE
11 DESCRIPTION
12 CLINICAL PHARMACOLOGY
  12.1 Mechanism of Action
  12.2 Pharmacodynamics
  12.3 Pharmacokinetics
13 NONCLINICAL TOXICOLOGY
  13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility
14 CLINICAL STUDIES
16 HOW SUPPLIED/STORAGE AND HANDLING
* Sections or subsections omitted from the full prescribing information are not listed.

Table 1 Preparation of diluted solutions

<table>
<thead>
<tr>
<th>Fluid restriction?</th>
<th>Final concentration</th>
<th>Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>0.1 units/mL</td>
<td>Vasostrict®</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diluent</td>
</tr>
<tr>
<td></td>
<td>2.5 mL (50 units)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1 unit/mL</td>
<td>5 mL (100 units)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 mL</td>
</tr>
</tbody>
</table>

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

2.2 Administration
The goal of treatment is optimization of perfusion to critical organs, but aggressive treatment can compromise perfusion of organs, like the gastrointestinal tract, whose function is difficult to monitor. The following advice is empirical. In general, titrate to the lowest dose compatible with a clinically acceptable response.

For post-cardiotomy shock, start with a dose of 0.03 units/minute. For septic shock, start with a dose of 0.01 units/minute. If the target blood pressure response is not achieved, titrate up by 0.005 units/minute at 10- to 15-minute intervals. The maximum dose for post-cardiotomy shock is 0.1 units/minute and for septic shock 0.07 units/minute. After target blood pressure has been maintained for 8 hours without the use of catecholamines, taper Vasostrict® by 0.005 units/minute every hour as tolerated to maintain target blood pressure.

3 DOSAGE FORMS AND STRENGTHS
Vasostrict® (vasopressin injection, USP) is a clear, practically colorless solution for intravenous administration available as 20 units/mL in a single dose vial and 200 units/10 mL (20 units/mL) in a multiple dose vial.

4 CONTRAINDICATIONS
Vasostrict® 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
Use in patients with impaired cardiac response may worsen cardiac output.

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

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.

7.2 Indomethacin
Use with indomethacin may prolong the effect of Vasostrict® on cardiac index and systemic vascular resistance [see Clinical Pharmacology (12.3)].

7.3 Ganglionic Blocking Agents
Use with ganglionic blocking agents may increase the effect of Vasostrict® on mean arterial blood pressure [see Clinical Pharmacology (12.3)].

7.4 Furosemide
Use with furosemide increases the effect of Vasostrict® on osmolar clearance and urine flow [see Clinical Pharmacology (12.3)].

7.5 Drugs Suspected of Causing SIADH
Use with drugs suspected of causing SIADH (e.g., SSRIs, tricyclic antidepressants, haloperidol, chlorpropamide, enalapril, methyl dopa, pentamidine, vincristine, cyclophosphamide, ifosfamide, etc.) may prolong the effect of Vasostrict® on cardiac index and systemic vascular resistance [see Clinical Pharmacology (12.3)].

7.6 Drugs Suspected of Fainting
Use with drugs suspected of causing fainting [see Clinical Pharmacology (12.3)] may prolong the effect of Vasostrict® on cerebral blood flow and cerebral oxygen saturation.
Felbamate may increase the pressor effect in addition to the anti-diuretic effect of Vasostrict®.

7.6 Drugs Suspected of Causing Diabetes Insipidus
Use with drugs suspected of causing diabetes insipidus (e.g., demeclocycline, lithium, toscaonet, clonidine) may decrease the pressor effect in addition to the anti-diuretic effect of Vasostrict®.

8 USE IN SPECIFIC POPULATIONS
8.1 Pregnancy
Pregnancy Category C
Risk Summary: There are no adequate or well-controlled studies of Vasostrict® in pregnant women. It is not known whether vasopressin can cause fetal harm when administered to a pregnant woman or can affect reproduction capacity. Animal reproduction studies have not been conducted with vasopressin [see Clinical Pharmacology (12.3)].
Clinical Considerations: Because of increased clearance of vasopressin in the second and third trimester, the dose of Vasostrict® may need to be up-titrated to doses exceeding 0.1 units/minute in post-cardiotomy shock and 0.07 units/minute in septic shock.
Vasostrict® may produce tonic uterine contractions that could threaten the continuation of pregnancy.
8.3 Nursing Mothers
It is not known whether vasopressin is present in human milk. However, oral absorption by a nursing infant is unlikely because vasopressin is rapidly destroyed in the gastrointestinal tract. Consider advising a nursing woman to pump and discard breast milk for 1.5 hours after receiving vasopressin to minimize potential exposure to the breastfed infant.
8.4 Pediatric Use
Safety and effectiveness of Vasostrict® 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
Overdose with Vasostrict® can be expected to manifest as consequences of vasoconstriction of various vascular beds (peripheral, mesenteric, and coronary) and as hyponatremia. In addition, overdose 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 that causes contraction of vascular and other smooth muscles and antidiuresis. Vasostrict® is a sterile, aqueous solution of synthetic arginine vasopressin for intravenous administration. The 1 mL solution contains vasopressin 20 units/mL, Water for Injection, USP and, sodium acetate buffer adjusted to a pH of 3.8. The 10 mL solution contains vasopressin 20 units/mL, chlorobutanol, NF 0.5% as a preservative, and Water for Injection, USP and, sodium acetate buffer adjusted to a pH of 3.8. The chemical name of vasopressin is Cyclo (1-6) L-Cysteinyl-L-Tyrosyl-L-Phenylalanyl-L-Glutaminyl-L-Asparaginyl-L-Cysteinyl-L-Prolyl-L-Arginyl-L-Glycinamide. It is a white to off-white amorphous powder, freely soluble in water. The structural formula is:

\[
H \quad \text{Cys} \quad \text{O}_{22} \quad \text{Asp} \quad \text{Arg} \quad \text{Gly} \quad \text{NH}_{2} \quad \text{NH}_{2} \quad \text{Asn} \quad \text{Lys} \quad \text{Ser} \\
1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9
\]

One mg is equivalent to 530 units.

12 CLINICAL PHARMACOLOGY
12.1 Mechanism of Action
The vasoconstrictive effects of vasopressin are mediated by vascular V1 receptors. Vascular V1 receptors are directly coupled to phospholipase C, resulting in release of calcium, leading to vasoconstriction. In addition, vasopressin stimulates antidiuresis via stimulation of V2 receptors which are coupled to adenyl 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 V1 receptors and release of protons via V2 receptors. At lower concentrations typical for the antidiuretic hormone vasopressin inhibits water diuresis via renal V2 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. Onset of the pressor effect of vasopressin is rapid, and the peak effect occurs 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
At infusion rates used in vasodilatory shock (0.01-0.1 units/minute) the clearance of vasopressin is 9 to 25 mL/min/kg in patients with vasodilatory shock. The apparent t1/2 of vasopressin at these levels is <10 minutes. Vasopressin is predominantly metabolized and only about 6% of the dose is excreted unchanged in the urine. Animal experiments suggest that the metabolism of vasopressin is primarily by liver and kidney. Serine protease, carboxypeptidase and disulfide oxidoreductase cleave vasopressin at sites relevant for the pharmacological activity of the hormone. Thus, the generated metabolites are not expected to retain important pharmacological activity.

Drug-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)].

Drug interactions with metoprolol, propranolol, and verapamil may increase the duration of the vasoconstrictive effects of 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 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.

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.

15 HOW SUPPLIED/STORAGE AND HANDLING
Vasostrict® (vasopressin injection, USP) is a clear, practically colorless solution for intravenous administration available as:

- NDC 42023-164-25: A carton of 25 single dose vials each containing vasopressin 1 mL at 20 units/mL.
- NDC 42023-190-01: A carton of 1 multiple dose vial containing vasopressin 10 mL at 200 units/10 mL (20 units/mL).

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 Vasostrict® beyond the manufacturer’s expiration date stamped on the vial. After initial entry into the 10 mL vial, the remaining contents must be refrigerated. Discard the refrigerated 10 mL vial after 30 days after first puncture.

The storage conditions and expiration periods are summarized in the following table.

<table>
<thead>
<tr>
<th></th>
<th>Unopened</th>
<th>Refrigerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>2°C to 8°C (36°F to 46°F)</td>
<td>12 months or until manufacturer expiration date, whichever is earlier</td>
<td>N/A</td>
</tr>
<tr>
<td>20°C to 25°C (68°F to 77°F) Do not store above 25°C (77°F)</td>
<td>12 months or until manufacturer expiration date, whichever is earlier</td>
<td>30 days</td>
</tr>
</tbody>
</table>

Distributed by:
Par Pharmaceutical
Chestnut Ridge, NY 10977

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