

# **PRODUCT MONOGRAPH**

## **INCLUDING PATIENT MEDICATION INFORMATION**

### **Pr VANCOMYCIN HYDROCHLORIDE FOR INJECTION USP (Vancomycin Hydrochloride)**

**500 mg/vial, 1 g/vial, 5 g/vial and 10 g/vial Vancomycin (as vancomycin hydrochloride)**

**Sterile lyophilized powder for solution**

Antibiotic

SteriMax Inc.  
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Oakville, Ontario  
L6H 6R4

DATE OF REVISION:  
JUL 31, 2024

Control No.: 284121

## Pr VANCOMYCIN HYDROCHLORIDE FOR INJECTION USP

### Antibiotic

#### ACTIONS

The inhibition of cell wall synthesis has been shown by *in vitro* studies to be responsible for the bactericidal action of vancomycin against many gram-positive bacteria. There is also evidence that RNA synthesis is selectively inhibited and the permeability of the cell membrane is altered by vancomycin.

#### INDICATIONS AND CLINICAL USE

Vancomycin Hydrochloride for Injection USP is indicated in the therapy of severe or life-threatening staphylococcal infections in patients who cannot receive or have failed to respond to the penicillins or cephalosporins, or who have infections with staphylococci resistant to other antibiotics, including methicillin.

To reduce the development of drug-resistant bacteria and maintain the effectiveness of Vancomycin Hydrochloride for Injection USP and other antibacterial drugs, Vancomycin Hydrochloride for Injection USP should be used only to treat infections that are proven or strongly suspected to be caused by susceptible bacteria. When culture and susceptibility information are available, they should be considered in selecting or modifying antibacterial therapy. In the absence of such data, local epidemiology and susceptibility patterns may contribute to the empiric selection of therapy.

In the treatment of staphylococcal endocarditis, vancomycin has been used successfully alone. In other infections due to staphylococci, including osteomyelitis, pneumonia, septicemia and soft-tissue infections, vancomycin's effectiveness has been documented. Antibiotics are used as adjuncts to appropriate surgical measures when staphylococcal infections are localized and purulent.

Although no controlled clinical efficacy trials have been conducted, intravenous vancomycin has been suggested by the American Heart Association and the American Dental Association as prophylaxis against bacterial endocarditis in patients allergic to penicillin who have congenital and/or rheumatic or other acquired valvular heart disease when they undergo dental procedures or surgical procedures of the upper respiratory tract. (Note: When selecting antibiotics for the prevention of bacterial endocarditis, the physician or dentist should read the full joint statement of the American Heart Association and the American Dental Association.)

For the treatment of staphylococcal enterocolitis and antibiotic-associated pseudomembranous colitis produced by *Clostridium difficile*, vancomycin should be used orally. Parenteral administration of vancomycin is not effective for these indications, therefore vancomycin must be given **orally**. For the treatment of other types of infection vancomycin is not effective by the oral route.

Specimens for bacteriological cultures should be obtained in order to isolate and identify the causative organisms and to determine their susceptibility to vancomycin.

## **CONTRAINDICATIONS**

Vancomycin Hydrochloride for Injection USP is contraindicated in patients with known hypersensitivity to the antibiotic.

## **WARNINGS**

Exaggerated hypotension, including shock, and rarely, cardiac arrest may result from rapid bolus administration (e.g., over several minutes) of vancomycin hydrochloride.

Toxic serum levels can occur when given intravenously. Vancomycin is excreted fairly rapidly by the kidney and with decreased renal clearance, blood levels increase markedly. The risk of toxicity appears appreciably increased by high blood concentrations or prolonged treatment during parenteral therapy. Orally, vancomycin is poorly absorbed. Therefore, toxic serum levels are not attained from oral dosage.

When serum levels exceed 80 mcg/mL, ototoxicity has occurred. Tinnitus may precede deafness. The elderly are more likely to experience auditory damage. Deafness may be progressive despite cessation of treatment, as experience with other antibiotics suggests.

Careful monitoring is required with concurrent and sequential use of other neurotoxic and/or nephrotoxic agents, particularly aminoglycoside antibiotics, cephaloridine, polymixin B, colistin, viomycin, paromomycin, cisplatin and neuromuscular blocking agents.

If parenteral and oral vancomycin are administered concomitantly, an additive effect may occur, which should be considered when calculating the total dose given. Levels of vancomycin in serum should be monitored in these circumstances.

## **Susceptibility/Resistance**

### **Development of Drug Resistant Bacteria**

Prescribing Vancomycin Hydrochloride for Injection USP in the absence of a proven or strongly suspected bacterial infection is unlikely to provide benefit to the patient and risks the development of drug-resistant bacteria.

## **PRECAUTIONS**

To avoid rapid infusion-related reactions, Vancomycin Hydrochloride for Injection USP should be administered in a dilute solution over a period of not less than 60 minutes. A prompt cessation of these reactions usually results when the infusion is stopped (see **DOSAGE AND ADMINISTRATION** and **ADVERSE REACTIONS**).

Vancomycin hydrochloride should be used with care in patients with renal insufficiency because of its ototoxicity and nephrotoxicity. The dose and/or dose intervals should be adjusted carefully and blood levels monitored if it is necessary to use vancomycin parenterally in patients with renal impairment.

In patients with previous hearing loss, vancomycin should be avoided (if possible). If used in such patients, the dose of vancomycin should be monitored by periodic determination of drug levels in blood. Serial tests of auditory function and of vancomycin blood levels should be performed in patients with renal insufficiency and in individuals over the age of 60. Periodic hematologic studies, urinalyses and liver and renal function tests should be taken in all patients receiving vancomycin.

The overgrowth of non-susceptible organisms may result with the use of vancomycin. Appropriate measures should be taken if new infections due to bacteria or fungi appear during therapy with this product. These measures should include the withdrawal of vancomycin.

In rare instances, there have been reports of pseudomembranous colitis due to *Clostridium difficile* developing in patients who receive intravenous vancomycin.

**Vancomycin should never be given intramuscularly.** Vancomycin is irritating to tissue and causes drug fever, pain and possibly necrosis if injected intramuscularly. Therefore, it must be administered intravenously. In many patients receiving vancomycin, pain and thrombophlebitis occur and are occasionally severe. By administering the drug in a volume of at least 200 mL of glucose or saline solution and by rotating the sites of injection, the frequency and severity of thrombophlebitis can be minimized.

The frequency of infusion-related events (including hypotension, flushing, erythema, urticaria and pruritus) has been reported to increase with concomitant administration of anesthetic agents. The administration of vancomycin hydrochloride as a 60-minute infusion prior to anesthetic induction may minimize infusion-related events.

The safety and efficacy of administering vancomycin by the intrathecal (intralumbar or intraventricular) routes have not been assessed.

Some patients with inflammatory disorders of the intestinal mucosa may have significant systemic absorption of oral vancomycin and may thus be at risk of developing adverse reactions associated with parenteral administration of vancomycin. This risk is greater in the presence of renal impairment. Total systemic and renal clearance of vancomycin are reduced in the elderly.

When patients with underlying renal dysfunction or those receiving concomitant therapy with an aminoglycoside are being treated, serial monitoring of renal function should be performed.

#### **Use in Pregnancy**

Vancomycin should be given during pregnancy only if clearly needed. Vancomycin levels of 13.2, and 16.7 mcg/mL were measured in cord blood of 2/10 pregnant women treated with vancomycin in a controlled clinical study of serious staphylococcal infection complicating intravenous drug abuse. Because the number of patients treated in this study was small and

vancomycin administered only in the second and third trimesters, it is not known whether vancomycin causes fetal harm.

### **Nursing Mothers**

Vancomycin is excreted in human milk. Caution should be exercised if vancomycin is administered to a nursing mother. The potential for adverse effects warrants that a decision be made whether to discontinue nursing of the infant or administration of vancomycin, taking into account the importance of the drug to the nursing mother.

### **Pediatrics**

In premature neonates and in young infants, it may be advisable to confirm desired serum levels of vancomycin.

Concomitant administration of vancomycin and anesthetic agents has been associated with erythema and histamine-like flushing in children.

### **Geriatrics**

Vancomycin dosage levels should be adjusted in elderly patients. The natural decrease in glomerular filtration rate with increasing age may lead to elevated concentrations of vancomycin in serum if dosages are not adjusted.

### **Burn Patients**

Burn patients reportedly have higher total body clearance rates for vancomycin and may thus require more frequent and higher doses. Dosage individualisation and close monitoring of burn patients being treated with vancomycin may be warranted.

## **ADVERSE REACTIONS**

### **Infusion-Related Events**

Associated with the administration of vancomycin are nausea, chills, fever, wheezing, dyspnea, pruritus, urticaria and macular rashes. Eosinophilia and anaphylactoid reactions may also be produced. A throbbing type of pain in the muscles of the back and neck has been described and can usually be minimized or avoided by slower administration (see DOSAGE AND ADMINISTRATION). There have been reports of hypotension which is more apt to occur with rapid administration. During rapid administration flushing of the skin over the neck and shoulder with transitory fine rash including urticaria ("red neck") has also been observed. These reactions may persist for several hours but usually resolve within 20 - 30 minutes.

### **Nephrotoxicity**

Renal failure has been reported rarely in patients treated with vancomycin, principally manifested by increased serum creatinine or BUN, particularly in patients given large doses. Most of these have occurred in patients who had pre-existing kidney dysfunction or who were given aminoglycosides concomitantly. Azotemia resolved in most patients upon discontinuance of vancomycin. Rare cases of interstitial nephritis have been reported in patients treated with vancomycin.

### **Ototoxicity**

Hearing loss associated with vancomycin has been reported by approximately two dozen patients. In most cases, patients also had kidney dysfunction, pre-existing hearing loss or concomitant treatment with an ototoxic drug. Rarely have there been reports of vertigo, dizziness and tinnitus.

### **Hematopoietic**

The development of reversible neutropenia, usually starting one week or more after onset of therapy with vancomycin or after a total dose of more than 25 g has been reported, including some 24 "spontaneous cases" from published reports and other sources. Upon discontinuance of vancomycin, neutropenia appears to be promptly reversible. Thrombocytopenia has been reported rarely. Reversible agranulocytosis (granulocyte count less than 5 000/mm<sup>3</sup>) has been reported rarely.

### **Phlebitis**

Inflammation at the injection site has been reported.

### **Miscellaneous**

Drug fever, exfoliative dermatitis, Stevens-Johnson syndrome, Drug Reaction with Eosinophilia and Systemic Symptoms (DRESS) Syndrome, Toxic Epidermal Necrolysis (TEN) and rare cases of vasculitis, have been associated with the administration of vancomycin.

## **OVERDOSAGE**

For management of a suspected drug overdose, contact your regional poison control centre.
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Hemofiltration and hemoperfusion with polysulfone resins reportedly results in increased clearance of vancomycin. As no specific antidote is known, general supportive treatment is indicated. Significant amounts of vancomycin are not removed by dialysis.

## **DOSAGE AND ADMINISTRATION**

### **DOSAGE**

**Each dose should be administered at a rate of no more than 10 mg/min or over a period of at least 60 minutes.**

### **Intravenous Dosage**

#### **Adults:**

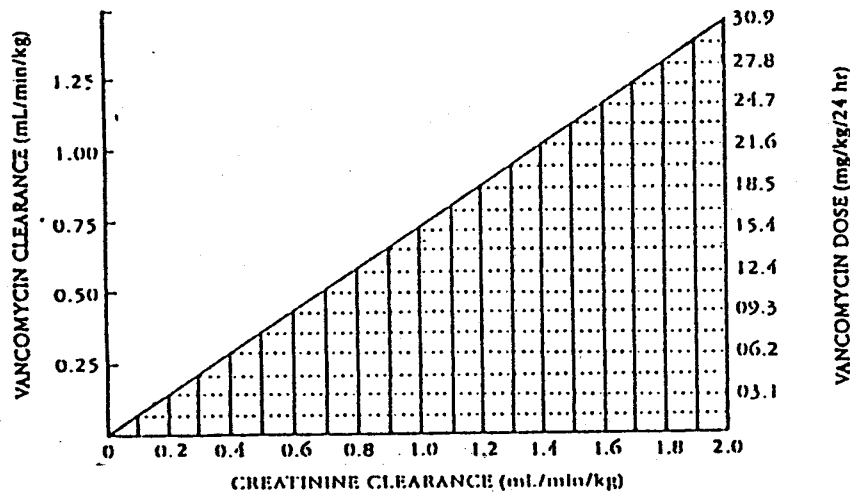
The usual intravenous dose is 500 mg every 6 hours or 1 g every 12 hours. Other patient factors such as age or obesity may call for modification of the usual intravenous daily dose.

#### **Adults with Impaired Renal Function:**

To avoid toxic serum levels dosage adjustment is required in patients with impaired renal function. Since accumulation in such patients has been reported to occur over several weeks of

treatment, serum levels should be checked regularly.

The dosage calculation may be made by using the following nomogram if the creatinine clearance value is known for most patients with renal impairment or the elderly:



(Moellering et al. 1981)

For functionally anephric patients on dialysis, the nomogram is not valid. In order to achieve therapeutic serum levels promptly in such patients, a loading dose of 15 mg/kg of body weight should be given. The dose required to maintain stable serum levels is 1.9 mg/kg/24 h.

When only serum creatinine is available, the conversion of this value into estimated creatinine clearance may be accomplished by using the following formula based on sex, weight and age of the patient.

A steady state of renal function is represented by the serum creatinine.

Males: 
$$\frac{\text{Weight (kg)} \times (140 - \text{age})}{72 \times \text{serum creatinine}}$$

Females: 0.85 x above value

#### Neonates, Infants and Children:

The dosage schedule which follows has been used. Infusions can be divided and incorporated in the child's 24-hour fluid requirement and should be infused over 60 minutes.

Infants and Neonates: It is suggested that an initial dose of 15 mg/kg be administered followed by 10 mg/kg every twelve hours for neonates in the first week of life and every eight hours thereafter up to the age of one month. Each dose should be given over 60 minutes. Close monitoring of serum concentrations of vancomycin may be warranted in these patients.

Children: The usual intravenous dosage of vancomycin is 10 mg/kg given every six hours.

The majority of patients with infections caused by organisms susceptible to the antibiotic demonstrate a therapeutic response by 48 to 72 hours. The total duration of therapy is determined by the type and severity of the infection and the clinical response of the patient. In staphylococcal endocarditis, therapy for three weeks or longer is recommended.

### **Oral Dose**

**Vancomycin, when administered orally, is to be used only in the treatment of staphylococcal enterocolitis, and/or pseudomembranous colitis associated with toxigenic *Clostridium difficile*.**

### **Adults:**

The usual daily dose for antibiotic-associated colitis and/or staphylococcal enterocolitis is 125 to 500 mg orally every 6 - 8 hours for 7 - 10 days.

### **Children**

The usual daily dosage is approximately 40 mg/kg in 3 or 4 divided doses for 7 - 10 days. The total daily dose should not exceed 2 g.

## **ADMINISTRATION**

### **Intermittent Intravenous Infusion:**

It is necessary to **further dilute** the reconstituted solution with 100 – 200 mL Normal Saline or D5W (dextrose in sterile water for injection). The infusion should be over a period of at least 60 minutes (see **PHARMACEUTICAL INFORMATION – Reconstitution**).

### **Continuous Intravenous Infusion:**

Only when intermittent infusion is not practical should continuous intravenous infusion be used. A concentration no greater than 10 mg/mL is recommended. An infusion of 10 mg/min or less is associated with fewer infusion-related adverse events.

### **Oral Administration:**

By diluting the contents of the intravenous vial (500 mg) in 30 mL of water, the patient is permitted to drink the antibiotic or the solution may be administered via nasogastric tube.

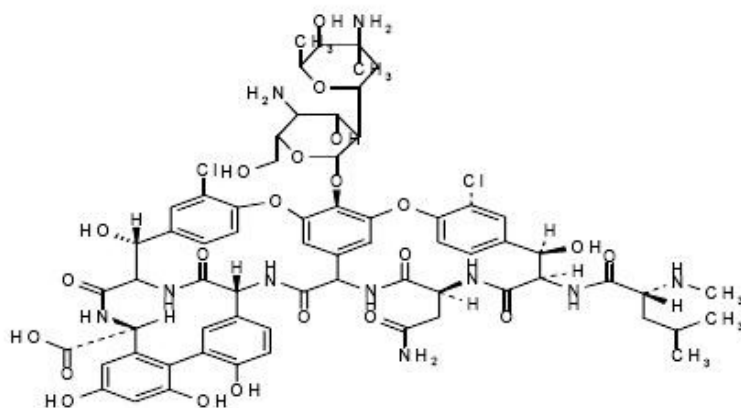
## PHARMACEUTICAL INFORMATION

### Drug Substance

Proper Name: Vancomycin hydrochloride

Chemical Name: (Sa)-(3S,6R,7R,22R,23S,26S,36R,38aR)-44-[[2-O-(3-amino-2,3,6-trideoxy-3-C-methyl- $\alpha$ -l-lyxo-hexopyranosyl)- $\beta$ -D-glucopyranosyl]oxy]-3-(carbamoylmethyl)-10,19-dichloro-2,3,4,5,6,7,23,24,25,26,36,37,38,38a-tetradecahydro-7,22,28,30,32-pentahydroxy-6-[(2R)-4-methyl-2-(methylamino)valeramido]-2,5,24,38,39-pentaoxo-22H-8,11:18,21-dietheno-23,36-(iminomethano)-13,16:31,35-dimetheno-1H,16H-[1,6,9]oxadiazacyclohexadecino[4,5-m]-[10,2,16]benzoxadiazacyclopentacosine-26-carboxylic acid, monohydrochloride.

Structural Formula:



**.HCl**

Molecular Formula: C<sub>66</sub>H<sub>75</sub>Cl<sub>2</sub>N<sub>9</sub>O<sub>24</sub>.HCl

Molecular Weight: 1485.73 g/mol

Description: Vancomycin hydrochloride is a tricyclic glycopeptide antibiotic. It is an off-white, free-flowing powder, very soluble in water at pH 4, moderately soluble in aqueous methanol, but insoluble in higher alcohols, acetone or ether. The melting point is 105 °C.

### COMPOSITION

Sterile vials contain vancomycin hydrochloride equivalent to either 500 mg, 1 g, 5 g or 10 g of vancomycin base as a lyophilized drug. When reconstituted in Sterile Water for Injection USP, it forms a clear solution with a pH of 4.0 (2.5 to 4.5). May contain hydrochloric acid and/or sodium hydroxide for pH adjustment.

## **Reconstitution**

### **Flip-Top Vial**

Solution for Reconstitution: Sterile Water for Injection

Reconstitute as follows (see Table 1):

<b>Table 1</b>			
<b>Reconstitution</b>			
<b>Flip-Top Vial Size</b>	<b>Volume to be Added to Vial</b>	<b>Approx. Available Volume</b>	<b>Vancomycin Concentration</b>
500 mg	10 mL	10.3 mL	50 mg/mL
1 g	20 mL	20.6 mL	50 mg/mL
5 g	100 mL	103.0 mL	50 mg/mL
10 g	95 mL	97.85 mL	100 mg/mL

### **Note: FURTHER DILUTION IS REQUIRED**

Complete dissolution may take as long as 3 or 5 minutes for the 5g and 10g, respectively.

### **For Intermittent Intravenous Infusion**

**500 mg vial:** Reconstituted solutions must be diluted with at least 100 mL of 0.9% Sodium Chloride Injection or 5% Dextrose in Sterile Water for Injection.

**1 g vial:** Reconstituted solutions must be diluted with at least 200 mL of 0.9% Sodium Chloride Injection or 5% Dextrose in Sterile Water for Injection.

**5 g vial:** **Further dilution of the reconstituted solution is required.** The 5 g vial is a Pharmacy Bulk Package intended for pharmacy use only.

**10 g vial:** **Further dilution of the reconstituted solution is required.** The 10 g vial is a Pharmacy Bulk Package intended for pharmacy use only.

### **For Continuous Intravenous Infusion**

The vials reconstituted according to **Table 1 (Reconstitution)** should be further diluted to the desired volume with one of the following intravenous solutions:

5% Dextrose Injection

3.3% Dextrose Injection and 0.3% Sodium Chloride Injection

Lactated Ringer's Injection

0.9% Sodium Chloride Injection

A concentration of no greater than 5 mg/mL is recommended.

### **Directions for Dispensing from Pharmacy Bulk Package:**

Pharmacy bulk packages (5 g and 10 g) are for use in a pharmacy admixture service only in suitable work area such as a laminar flow hood. The pharmacy bulk package should be hung by the integral labeling hanger and suspended in the laminar flow hood. The container closure should be penetrated only one time utilizing a suitable sterile dispensing set which allows measured distribution of the contents. Use of a syringe and needle is not recommended as it may cause leakage. Insert the dispensing set into the pharmacy bulk package using aseptic technique.

Once the sterile dispensing set has been inserted into the container, withdrawal of the contents should be accomplished without delay. However, if this is not possible, a maximum time of **8 hours** from the initial entry may be allowed to complete fluid aliquoting/transferring operations. This time limit should begin with the introduction of solution or diluent into the pharmacy bulk package. Discard the container no later than **8 hours** after initial closure puncture.

### **STABILITY AND STORAGE RECOMMENDATIONS**

#### Dry Powder

Vancomycin hydrochloride powder should be stored between 15 °C and 25 °C.

#### Solutions

Reconstituted solutions and further diluted infusion mixtures should be used within 24 hours if kept at room temperature or within 72 hours if stored under refrigeration (5°C). If prepared in a facility with a recognized parenteral intravenous admixture program, such mixtures may be kept up to 96 hours if stored under refrigeration (5°C).

**NOTE:** As with all parenteral drug products, intravenous admixtures should be inspected visually for clarity, particulate matter, precipitate, discoloration and leakage prior to administration whenever solution and container permit. Solutions showing haziness, particulate matter, precipitate, discoloration or leakage should not be used. Single-dose vials. Discard unused portion.

#### Incompatibility

The following are some of the specific substances found to be incompatible: aminophylline, amobarbital sodium, chloramphenicol sodium succinate, chlorothiazide sodium, dexamethasone sodium phosphate, methicillin sodium, vitamin B complex with C, heparin sodium, penicillin G potassium, phenobarbital sodium, phenytoin sodium, secobarbital sodium, sodium bicarbonate, and warfarin sodium.

**NOTE:** Common flavouring syrups have been added to the solution to improve the taste for oral administration. There is no information to indicate that the potency or efficacy of the drug is affected by the addition of these agents.

## **AVAILABILITY OF DOSAGE FORMS**

Vancomycin Hydrochloride for Injection USP is supplied as a sterile, lyophilized powder of vancomycin hydrochloride equivalent to:

- 500 mg vancomycin base in 10 or 20 mL single-dose glass vials, closed with rubber stoppers and flip-off caps. Packages of 10 (20 mL vials) or 25 (10 mL vials).
- 1 g vancomycin base in 20 mL single-dose glass vials, closed with rubber stoppers and flip-top caps. Packages of 10.
- 5 g vancomycin base in 100 mL single-use glass vials, closed with rubber stoppers and flip-top caps. Vials are individually packaged.\*
- 10 g vancomycin base in 100 mL single-use glass vials, closed with rubber stoppers and flip-top caps. Vials are individually packaged.\*

\* The 5 g and 10 g vials have labels with integrated hangers which can be peeled back and used to suspend the bottle as a unit in a laminar air flow hood.

## **MICROBIOLOGY**

Vancomycin hydrochloride has not demonstrated cross-resistance with other classes of antibiotics. A slow, stepwise laboratory-induced resistance has been reported to occur. Neither changes in pH nor the presence of serum significantly alter vancomycin's activity. Most strains of the following organisms are sensitive in vitro and in clinical infections to vancomycin:

*Staphylococcus aureus* (including heterogenous methicillin-resistant strains)

*Clostridium difficile*

*Staphylococcus epidermidis* (including heterogenous methicillin-resistant strains)

*Streptococcus pneumoniae* (including multiple-resistant strains)

*Streptococcus pyogenes* (group A beta-hemolytic)

*Streptococcus agalactiae* (group B beta-hemolytic)

*Streptococcus bovis*

*Alpha-hemolytic streptococci* (viridans groups)

*Enterococci* (e.g., *Staphylococcus fecalis*)

*Bacillus* sp.

*Listeria monocytogenes*

*Lactobacillus* sp.

*Neisseria* sp.

*Diphtheroids*

*Actinomyces* sp.

**NOTE:** *In vitro*, many strains of streptococci, staphylococci, *Clostridium difficile*, and other gram-positive bacteria are susceptible to concentrations of 0.5 to 5 mcg/mL. A small proportion of *Staphylococcus aureus* strains requires 10 to 20 mcg/mL for inhibition, whereas staphylococci are generally susceptible to less than 5 mcg/mL of vancomycin

hydrochloride. *In vivo* and *in vitro* resistance to vancomycin has been reported in clinically significant coagulase negative staphylococci identified as *Staphylococcus hemolyticus*.

Enterococci of various species resistant to vancomycin and related glycopeptide antibiotics have been isolated from hospitalised patients in France, UK, and in the USA. Transfer of resistance to *Enterococcus faecium*, or *Enterococcus faecalis*, and to *Streptococcus sanguis* has also been documented.

*In vitro*, vancomycin is not effective against gram-negative bacilli, mycobacteria, or fungi.

**TABLE 2**  
***In Vitro* Activity of Vancomycin**

<u>Organism</u>	<u>Number of Strains</u>	<u>MIC (mcg/mL)</u> <u>Range</u>	<u>Median</u>
<i>Staphylococcus aureus</i>	7343835	* $\leq$ 1.0 0.25 - 1.0 0.8 - 6.25	- - -
<i>Staphylococcus aureus</i> (methicillin-resistant)	241554	1.0 – 4.0 0.25 - 2.0 0.5 - 1.0	- - -
<i>Staphylococcus epidermidis</i>	29488	0.1 - 6.25 * $\leq$ 2.0	- -
<i>Streptococcus pneumoniae</i>	18	$\leq$ 0.06 - 0.5 0.3 - 1.0	- -
<i>Streptococcus pyogenes</i>	12	0.8 - 3.1	-
<i>Streptococcus viridans</i>	8221	0.39 - 1.56 * $\leq$ 1.0	0.78 -
<i>Streptococcus fecalis</i>	382	0.8 - >100	3.1
<i>Clostridium perfringens</i>	43	0.4 - 1.6	0.8
<i>C. ramosum</i>	49	3.1 - 12.5	6.2
<i>Clostridium difficile</i>	1478	< 0.4 - 3.1 1.0 - 4.0	- -

\* Given in reference as MIC<sub>100</sub>

#### **Methods of Susceptibility Testing**

A 30 mcg disc of vancomycin should produce a zone of more than 11 mm when in contact with "susceptible" organisms when the standardized method of disc susceptibility testing is used. Intermediate susceptibility is indicated by a zone size of 10 - 11 mm and resistance is indicated by a zone size of 9 mm or less.

Susceptibility to vancomycin is indicated by an MIC of  $\leq 5$  mcg/mL with the WHO-ICS agar dilution and broth dilution methods.

### **Assay Methods**

Bennett's agar-well diffusion method, which can quantitatively measure vancomycin concentrations from 0.5 to 8 mcg/mL, can be used to determine vancomycin serum and tissue levels.

Two disc-diffusion assay methods, both using *Bacillus subtilis* as the test organism, are available for vancomycin. Antibiotic medium No. 5 is used in the first method which is capable of measuring vancomycin levels from approximately 5 to 40 mcg/mL. Vancomycin concentrations from about 0.8 to 25 mcg/mL can be detected with the second method which uses minimal salt agar. A reliable bioassay for vancomycin (in concentrations of 0.78 to 50.0 mcg/mL) in the presence of rifampin or aminoglycosides is permitted with modification of the latter assay. An automated fluorescence polarization immunoassay and a radio-immunoassay are two available commercially prepared assay methods.

## **PHARMACOLOGY**

### **Human Pharmacology**

#### **Adults:**

#### **Intravenous Administration**

Multiple 500 mg dosages infused over 30 minutes every 6 hours gave peak concentrations ranging from 41 - 57 mcg/mL. Mean peak plasma concentrations were 64 mcg/mL immediately post infusion, 12.5 mcg/mL at 6 hours and 7 mcg/L at 12 hours post infusion following multiple 60 minute 1 g intravenous infusions of vancomycin in healthy volunteers.

A single intravenous injection of 1 g infused over a period of 30 minutes produced peak levels of 85 mcg/mL after 2 hours, 11 mcg/mL at 6 hours, and 5.1 mcg/mL at 12 hours. A single injection of 500 mg resulted in mean serum concentrations of 51 mcg/mL, with levels of 18.6 mcg/mL, and 5.8 mcg/mL at 6, and 12 hours respectively. Plasma half-life ranged from 3 - 8 hours with a mean of 4.5 hours.

#### **Renal Insufficiency**

Twenty-nine anephric patients were infused with 1 g of vancomycin in 250 mL of D5W over 30 minutes. The serum concentration was still 3.5 mcg/mL after 18 days with intermittent dialysis at 3- day intervals. The half-life of elimination was about 7.5 days.

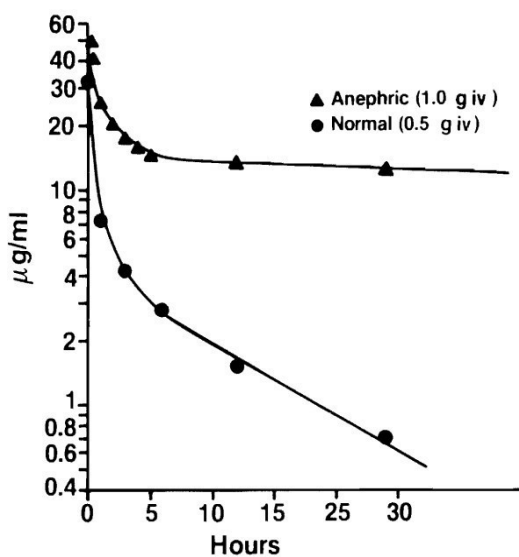


Figure 1. Elimination of vancomycin by anephric patients and by patients with normal renal function.

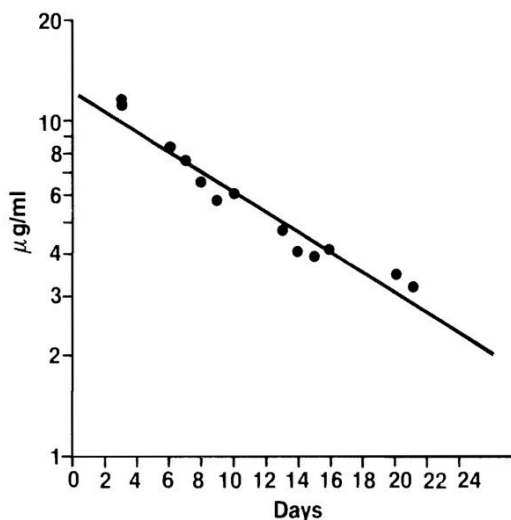


Figure 2. Elimination of vancomycin after a single 1 g intravenous dose by anephric patients undergoing hemodialysis at three-day intervals.

**Table 3.** Pharmacokinetic parameters of vancomycin in anephric and normal patients, as analyzed by two-compartment distribution.

Type of patient	Parameters*							
	C <sub>pO</sub> (mcg/ml)	K <sub>21</sub> (days <sup>-1</sup> )	K <sub>el</sub> (days <sup>-1</sup> )	K <sub>12</sub> (days <sup>-1</sup> )	t <sub>1/2</sub> (β) (days)	Cl (ml/min)	Vd (liters)	Vc (liters)
Anephric	48.3	5.74	0.32	10.69	7.5	6.88	67.6	24.5
Normal <sup>†</sup> [8]	33.4	5.95	10.25	18.64	0.37	110	119.1	14.97

\* C<sub>pO</sub> = peak concentration in serum; K<sub>21</sub> and K<sub>12</sub> = first-order rate constants for distribution of drug from tissue into plasma and from plasma into tissue, respectively; K<sub>el</sub> = elimination rate constant; t<sub>1/2</sub>(β) = elimination half-life; Cl = rate of drug clearance; Vd = apparent volume of distribution; Vc = volume of distribution in central compartment. Values given are means.

<sup>†</sup>This group was composed of patients with normal renal function. (Cunha *et al.* 1981)

### Oral Administration

Vancomycin is poorly absorbed after oral administration, only trace amounts are found in urine and blood. Following a dose of 125 mg orally four times daily, the mean concentration of vancomycin in stools was approximately 350 mcg/g. After up to ten daily doses of 2 g, a mean level of 3 100 mcg/g (with a range of 905 – 8760 mcg/g) was detected in feces of patients with pseudomembranous colitis.

### Tissue Penetration and Distribution

#### Central Nervous System

Vancomycin does not readily diffuse across normal meninges into spinal fluid, but penetrates into spinal fluid when the meninges are inflamed.

#### Other Tissues and Fluids

Vancomycin concentrations in human bile, pleural, ascitic, pericardial, and synovial fluids reach approximately one-third of the equivalent serum level after single intravenous doses. A level of 7.6 mcg/mL was achieved in the brain cyst of an infant following intravenous infusion of 40 mg/kg daily for 4 days.

## TOXICOLOGY

### Acute Toxicity

**Table 4**  
**LD<sub>50</sub> (mg/kg) of Vancomycin in Various Animals**

<b>Route of Administration</b>	<b>Rat</b>	<b>Mouse</b>	<b>Dog</b>
Intravenous	319 ± 14	489 ± 41	292 ± 29
Intraperitoneal	2218 ± 240	1734 ± 227	--
Subcutaneous	--	> 5 000	--
Oral	--	> 5 000	--

Dogs died several days after drug administration, generally from kidney failure, while rats died quickly from CNS-mediated effects.

Vancomycin caused a slight dose-related drop in blood pressure, when administered intravenously in a 5 percent solution to dogs at a rate of 0.6 mL/minute. Blood pressure dropped dramatically, as much as 40%, when the same dogs were given the same doses at a rate of 15 mL/minute. It is unknown, at present, whether the response is due to a direct effect on histamine receptors, or to the possible release of histamine from mast cells.

### Chronic Toxicity

Vancomycin was given to dogs in daily doses of 12.5, 25 and 50 mg/kg for 21 - 311 days. Renal damage was seen in 4/22 dogs receiving 50 mg/kg/day.

Irritation at the injection site was the only toxic effect resulting from the daily intravenous administration of 25 or 50 mg/kg to monkeys for 16 to 187 days.

No evidence of systemic toxicity was seen in cats receiving daily intramuscular doses of 25 and 50 mg/kg for 3 months.

Nine guinea pigs that received 100 mg vancomycin subcutaneously did not develop anaphylaxis when challenged 25 days later with a 25 mg intravenous dose.

Neither 150 mg vancomycin nor 60 mg tobramycin given alone to rats produced nephrotoxicity. However, significant renal toxicity occurred when administered together.

Ototoxicity was not produced in a guinea pig model administered 1000 mg/kg vancomycin and 40 mg/kg ethacrynic acid concurrently.

Neuromuscular blocking has not been demonstrated in rabbits treated with vancomycin.

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## PATIENT MEDICATION INFORMATION

### READ THIS FOR SAFE AND EFFECTIVE USE OF YOUR MEDICINE

#### Pr VANCOMYCIN HYDROCHLORIDE FOR INJECTION USP (Vancomycin Hydrochloride)

**500 mg/vial, 1 g/vial, 5 g/vial and 10 g/vial Vancomycin (as vancomycin hydrochloride)  
Sterile lyophilized powder for solution**

Read this carefully before you start taking Vancomycin Hydrochloride for Injection USP and each time you get a refill. This leaflet is a summary and will not tell you everything about this drug. Talk to your healthcare professional about your medical condition and treatment and ask if there is any new information about Vancomycin Hydrochloride for Injection USP.

#### **What is Vancomycin Hydrochloride for Injection USP used for?**

Vancomycin is used to treat bacterial infections in many different parts of the body such as:

- Heart
- Bone
- Lung
- Blood
- Skin and muscle

Vancomycin is typically used for serious infections for which other medicines may not work.

**Antibacterial drugs like Vancomycin Hydrochloride for Injection USP treat only bacterial infections. They do not treat viral infections such as the common cold. Although you may feel better early in treatment, Vancomycin Hydrochloride for Injection USP should be used exactly as directed. Misuse or overuse of Vancomycin Hydrochloride for Injection USP could lead to the growth of bacteria that will not be killed by Vancomycin Hydrochloride for Injection USP (resistance). This means that Vancomycin Hydrochloride for Injection USP may not work for you in the future. Do not share your medicine.**

#### **How does Vancomycin Hydrochloride for Injection USP work?**

Vancomycin hydrochloride is in a family of medications called glycopeptide antibiotics. It works by preventing the growth of certain types of bacteria.

#### **What are the ingredients in Vancomycin Hydrochloride for Injection USP?**

**Medicinal ingredients:** Vancomycin hydrochloride

**Non-medicinal ingredients:** Sodium hydroxide and hydrochloric acid

**Vancomycin Hydrochloride for Injection USP comes in the following dosage forms:**

Vancomycin Hydrochloride for Injection USP comes as a sterile powder. It is supplied in vial. Each vial may contain:

- 500 mg of vancomycin (as vancomycin hydrochloride)
- 1 g of vancomycin (as vancomycin hydrochloride)
- 5 g of vancomycin (as vancomycin hydrochloride)
- 10 g of vancomycin (as vancomycin hydrochloride)

**Do not use Vancomycin Hydrochloride for Injection USP if:**

- You are allergic to vancomycin hydrochloride.

**To help avoid side effects and ensure proper use, talk to your healthcare professional before you take Vancomycin Hydrochloride for Injection USP. Talk about any health conditions or problems you may have, including if you:**

- Have kidney problems
- Have hearing problems
- Are pregnant or planning to become pregnant
- Are breast feeding

**Other warnings you should know about Vancomycin Hydrochloride for Injection USP:**

**While you are using Vancomycin Hydrochloride for Injection USP**

- **Elderly:** Vancomycin Hydrochloride for Injection USP may cause damage to your hearing and kidneys (see the “Serious side effects and what to do about them” table below). These side effects may be more likely to occur in elderly patients. During your treatment your healthcare professional may require that you do blood, kidneys and hearing tests.
- If you are going to have surgery, including dental surgery, tell your healthcare professional that you are receiving vancomycin. Vancomycin may affect other medicines used during surgery.
- If you develop severe diarrhea (very loose or watery stool), tell your healthcare professional right away. Diarrhea may mean that you have a serious condition affecting your bowel (colitis). You may need urgent medical care. Do not try to treat loose stools without first checking with your healthcare professional (see the “Serious side effects and what to do about them” table below).
- Stop taking vancomycin at the first sign of a skin rash and call your healthcare professional. Skin rash may be a sign of a more serious reaction to vancomycin (see the “Serious side effects and what to do about them” table below).
- **Driving and using machines:** This medicine may cause dizziness in some people. If this occurs, do not drive, use machines or do anything else that could be dangerous.

**Tell your healthcare professional about all the medicines you take, including any drugs, vitamins, minerals, natural supplements or alternative medicines.**

**The following may interact with Vancomycin Hydrochloride for Injection USP:**

- Other medications in the antibiotics family such as:
  - aminoglycoside antibiotics such as amikacin, gentamicin, kanamycin, paromomycin, tobramycin etc.
  - cephaloridine (not marketed in Canada)
  - polymixin B
  - colistin
  - viomycin (not marketed in Canada)
- Cisplatin, a medicine used to treat cancer
- Medications given during surgery to relax the muscles (neuromuscular blocking agents)

Always keep a list of your medicines and show it to your healthcare professional when you get a new medicine. It is important that your healthcare professional reviews all medications and supplements you are taking before prescribing Vancomycin Hydrochloride for Injection USP.

**How to take Vancomycin Hydrochloride for Injection USP:**

- Vancomycin Hydrochloride for Injection USP is usually injected slowly into the vein over a period of at least 60 minutes. You may receive it at the hospital, or clinic.
- Under certain circumstances, Vancomycin Hydrochloride for Injection USP may also be given orally to treat colitis (inflammation of the intestine caused by certain bacteria) that may occur after antibiotic treatment.

**Usual dose:**

- Your healthcare professional will work out the right amount (dose) of medicine for you. The dose will depend on:
  - the medical problem for which you are using vancomycin
  - your weight, age
  - how well your kidneys are working and other factors.
- Your healthcare professional will explain to you the dosing instructions for Vancomycin Hydrochloride for Injection USP (amount of medicine to take, number of doses to take each day, the time allowed between doses, and how long you need to take this medicine).
- Ask your healthcare professional if you have any questions about the dosing instructions.

**Overdose:**

Your healthcare professional is trained to recognize the symptoms of an overdose, and deal with its symptoms.

If you think you, or a person you are caring for, have taken too much Vancomycin Hydrochloride for Injection USP, contact a healthcare professional, hospital emergency department, or regional poison control centre immediately, even if there are no symptoms.

**Missed Dose:**

If you have missed a dose of medication, call your healthcare professional to find out what to do.

**What are possible side effects from using Vancomycin Hydrochloride for Injection USP?**

These are not all the possible side effects you may feel when taking Vancomycin Hydrochloride for Injection USP. If you experience any side effects not listed here, contact your healthcare professional.

See also the “To help avoid side effects and ensure proper use...” section.

Check with your healthcare professional if any of these side effects persist or become troublesome:

- Headache.
- Shortness of breath.
- Sick to stomach.
- Rash, irritation, pain, redness or swelling where the shot is given.
- Tiredness.
- Vomiting.
- Fever.
- Diarrhea.

<b>Serious side effects and what to do about them</b>			
<b>Symptom / effect</b>	<b>Talk to your healthcare professional</b>		<b>Stop taking drug and get immediate medical help</b>
	<b>Only if severe</b>	<b>In all cases</b>	
<b>Unknown frequency</b>			
<b>Reactions that may occur during your infusion or soon after your infusion is completed:</b> <ul style="list-style-type: none"> <li>• Chills,</li> <li>• itching or skin irritation, nausea, shortness of breath, wheezing, rash on the face, neck, trunk, and arms</li> <li>• flushing of the skin over the neck and shoulder (“red neck”)</li> </ul>		✓	
<b>Serious life-threatening skin reactions</b> (Stevens-Johnson syndrome, Toxic Epidermal Necrolysis, Drug Reaction/Rash with Eosinophilia and Systemic Symptoms (DRESS)): <ul style="list-style-type: none"> <li>• unexplained widespread skin pain</li> <li>• flu-like symptoms (fever, sore mouth and throat, cough, fatigue, burning eyes etc.)</li> <li>• followed by a painful red or purplish rash that spreads and blisters on mouth, nose, eyes and genital</li> <li>• shedding of your skin within days after blisters form</li> <li>• swelling of the face or swollen glands in the neck, armpits or groin</li> <li>• yellowing of your skin or eye</li> <li>• dark urine, light-colored bowel movements;</li> <li>• severe nausea or vomiting; stomach pain</li> </ul>			✓
<b>Rare</b>			
<b>Allergic reactions:</b> <ul style="list-style-type: none"> <li>• severe rash, hives, itching</li> <li>• swelling of face, lips, mouth, throat or tongue</li> <li>• wheezing</li> <li>• tightness in the chest or throat</li> <li>• difficulty breathing or talking</li> </ul>			✓
<b>Kidney problems:</b> <ul style="list-style-type: none"> <li>• unable to pass urine</li> <li>• change in the amount of urine you pass</li> </ul>			✓

<ul style="list-style-type: none"> <li>• Pain in urinating, blood in the urine</li> <li>• Tiredness, nausea, vomiting</li> <li>• Swollen hands and feet</li> </ul>			
<b>Hearing problems:</b> <ul style="list-style-type: none"> <li>• dizziness, problems with balance</li> <li>• vertigo (spinning sensation)</li> <li>• ringing in the ears (is a potential warning sign of hearing loss)</li> <li>• change in hearing</li> <li>• temporary or permanent hearing loss</li> </ul>			✓
<b>Blood problems</b> (neutropenia, agranulocytosis) (usually found when your doctor orders tests) <ul style="list-style-type: none"> <li>• more likely to develop infections, sore throat, fever, chills, and other signs of infection</li> </ul>			✓
<b>Bowel infection (Clostridium difficile colitis):</b> May happen 2 or more months after your treatment <ul style="list-style-type: none"> <li>• diarrhea that does not go away (bloody or watery) with or without: <ul style="list-style-type: none"> <li>○ fever</li> <li>○ stomach cramps</li> </ul> </li> </ul>			✓
<b>Vasculitis</b> (inflammation of your blood vessels): <ul style="list-style-type: none"> <li>• fever</li> <li>• headache</li> <li>• fatigue</li> <li>• weight loss</li> <li>• general aches and pains</li> <li>• night sweats</li> <li>• rash</li> <li>• nerve problems, such as numbness or weakness</li> </ul>		✓	

If you have a troublesome symptom or side effect that is not listed here or becomes bad enough to interfere with your daily activities, talk to your healthcare professional.

### **Reporting Side Effects**

You can report any suspected side effects associated with the use of health products to Health Canada by:

- Visiting the Web page on Adverse Reaction Reporting (<https://www.canada.ca/en/health-canada/services/drugs-health-products/medeffect-canada/adverse-reaction-reporting.html>) for information on how to report online, by mail or by fax; or
- Calling toll-free at 1-866-234-2345.

*NOTE:* Contact your health professional if you need information about how to manage your side effects. The Canada Vigilance Program does not provide medical advice.

### **Storage:**

- Store Vancomycin Hydrochloride for Injection USP powder between 15°C and 25 °C.
- Reconstituted solutions and further diluted infusion mixtures should be used within 24 hours if kept at room temperature or within 72 hours if stored under refrigeration (5 °C).
- Most of the time, Vancomycin Hydrochloride for Injection USP will be given in a hospital.
- Keep out of reach and sight of children.

### **If you want more information about Vancomycin Hydrochloride for Injection USP:**

- Talk to your healthcare professional
- Find the full product monograph that is prepared for healthcare professionals and includes this Patient Medication Information by visiting the Health Canada website (<https://www.canada.ca/en/health-canada/services/drugs-health-products/drug-products/drug-product-database.html>); the manufacturer's website [www.sterimaxinc.com](http://www.sterimaxinc.com), or by calling 1-800-881-3550.

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