

STERILE VANCOMYCIN HYDROCHLORIDE, USP

PHARMACY BULK PACKAGE – NOT FOR DIRECT INFUSION

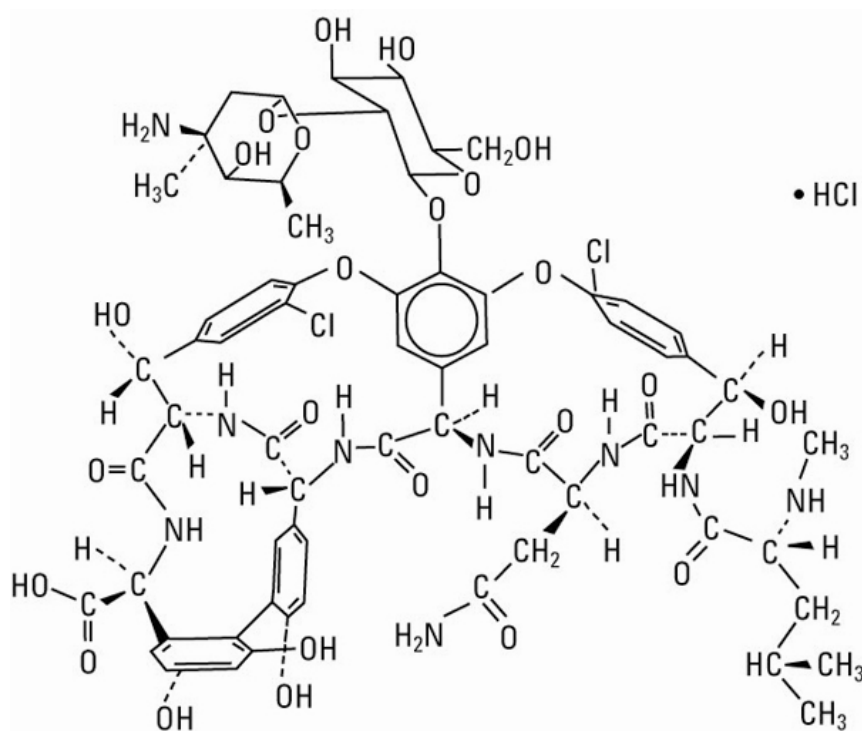
R_x only

To reduce the development of drug-resistant bacteria and maintain the effectiveness of vancomycin and other antibacterial drugs, vancomycin should be used only to treat or prevent infections that are proven or strongly suspected to be caused by bacteria.

DESCRIPTION

Sterile Vancomycin Hydrochloride, USP is a white to tan lyophilized powder, for preparing intravenous (IV) infusions. Each Pharmacy Bulk Package contains the equivalent of 10 grams vancomycin base. 500 mg of the base is equivalent to 0.34 mmol. When reconstituted as directed each 5 mL contains 500 mg and each 10 mL contains 1 gram. The reconstituted product is a clear light to dark tan solution with a pH in the range of 2.5 to 4.5. Sterile Vancomycin Hydrochloride, USP should be administered intravenously in diluted solution (see **DOSAGE AND ADMINISTRATION**).

Sterile Vancomycin Hydrochloride, USP is a tricyclic glycopeptide antibiotic derived from *Amycolatopsis orientalis* (formerly *Nocardia orientalis*). Vancomycin hydrochloride has the following structural formula:



$C_{66}H_{75}Cl_2N_9O_{24} \cdot HCl$

1485.71

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

A Pharmacy Bulk Package is a sterile dosage form containing many single doses for intravenous infusion. The contents are intended for use in pharmacy admixture program and are restricted to the preparation of admixtures for Intravenous infusion. When reconstituted as directed with Sterile Water for Injection to a concentration of 100 mg/mL, the pH of the solution is between 2.5 and 4.5. Sterile Vancomycin Hydrochloride, USP should be administered intravenously in diluted solution (see ***DOSAGE AND ADMINISTRATION***).

AFTER RECONSTITUTION FURTHER DILUTION IS REQUIRED BEFORE USE.

CLINICAL PHARMACOLOGY

In subjects with normal kidney function, multiple intravenous dosing of 1 g of vancomycin (15 mg/kg) infused over 60 minutes produces mean plasma concentrations of approximately 63 mcg/mL immediately at the completion of infusion, mean plasma concentrations of approximately 23 mcg/mL two hours after infusion, and mean plasma concentrations of approximately 8 mcg/mL 11 hours after the end of the infusion. Multiple dosing of 500 mg infused over 30 minutes produces mean plasma concentrations of about 49 mcg/mL at the completion of infusion, mean plasma concentrations of about 19 mcg/mL two hours after infusion, and mean plasma concentrations of about 10 mcg/mL six hours after infusion. The plasma concentrations during multiple dosing are similar to those after a single dose.

The mean elimination half-life of vancomycin from plasma is four to six hours in subjects with normal renal function. In the first 24 hours, about 75% of an administered dose of vancomycin is excreted in urine by glomerular filtration. Mean plasma clearance is about 0.058 L/kg/hr, and mean renal clearance is about 0.048 L/kg/hr. Renal dysfunction slows excretion of vancomycin. In anephric patients, the average half-life of elimination is 7.5 days. The distribution coefficient is from 0.3 to 0.43 L/kg. There is no apparent metabolism of the drug. About 60% of an intraperitoneal dose of vancomycin administered during peritoneal dialysis is absorbed systemically in six hours. Serum concentrations of about 10 mcg/mL are achieved by intraperitoneal injection of 30 mg/kg of vancomycin. However, the safety and efficacy of the intraperitoneal use of vancomycin has not been established in adequate and well-controlled trials (see ***PRECAUTIONS***).

Total systemic and renal clearance of vancomycin may be reduced in the elderly.

Vancomycin is approximately 55% serum protein bound as measured by ultrafiltration at vancomycin serum concentrations of 10 to 100 mcg/mL. After I.V. administration of vancomycin, inhibitory concentrations are present in pleural, pericardial, ascitic, and synovial fluids; in urine; in peritoneal dialysis fluid; and in atrial appendage tissue. Vancomycin does not readily diffuse across normal meninges into the spinal fluid; but, when the meninges are inflamed, penetration into the spinal fluid occurs.

Microbiology:

The bactericidal action of vancomycin results primarily from inhibition of cell-wall biosynthesis. In addition, vancomycin alters bacterial-cell-membrane permeability and RNA synthesis. There is no cross-resistance between vancomycin and other antibiotics. Vancomycin is not active *in vitro* against gram-negative bacilli, mycobacteria, or fungi.

Synergy:

The combination of vancomycin and an aminoglycoside acts synergistically *in vitro* against many strains of *Staphylococcus aureus*, *Streptococcus bovis*, enterococci, and the viridans group streptococci.

Vancomycin has been shown to be active against most strains of the following microorganism, both *in vitro* and in clinical infections as described in the **INDICATIONS AND USAGE** section.

Aerobic gram-positive microorganisms

Diphtheroids

Enterococci (e.g., *Enterococcus faecalis*)

Staphylococci, including *Staphylococcus aureus* and *Staphylococcus epidermidis* (including heterogeneous methicillin-resistant strains)

Streptococcus bovis

Viridans group streptococci

The following *in vitro* data are available, **but their clinical significance is unknown.**

Vancomycin exhibits *in vitro* MIC's of 1 mcg/mL or less against most ($\geq 90\%$) strains of streptococci listed below and MIC's of 4 mcg/mL or less against most ($\geq 90\%$) strains of other listed microorganisms; however, the safety and effectiveness of vancomycin in treating clinical infections due to these microorganisms have not been established in adequate and well-controlled clinical trials.

Aerobic gram-positive microorganisms

Listeria monocytogenes

Streptococcus pyogenes

Streptococcus pneumoniae (including penicillin-resistant strains)

Streptococcus agalactiae

Anaerobic gram-positive microorganisms

Actinomyces species

Lactobacillus species

Susceptibility Test Methods**Dilution Techniques**

Quantitative methods are used to determine antimicrobial minimum inhibitory concentrations (MIC's). These MIC's provide estimates of the susceptibility of bacteria to antimicrobial compounds. The MIC's should be determined using a standardized procedure. Standardized procedures are based on dilution method¹ (broth or agar) or equivalent using standardized inoculum concentrations and standardized concentrations of vancomycin powder. The MIC values should be interpreted according to the following criteria:

For testing aerobic microorganisms* other than streptococci:

<u>MIC (mcg/mL)</u>	<u>Interpretation</u>
≤4	Susceptible (S)
8-16	Intermediate (I)
≥32	Resistant (R)

* A β-lactamase test using an inoculum ≥10⁷ CFU/mL (or direct colony growth) and a nitrocefin-based substrate should be performed to detect either ampicillin or penicillin resistance among enterococci due to β-lactamase production.

For testing streptococci* other than *Streptococcus pneumoniae*:

<u>MIC (mcg/mL)</u>	<u>Interpretation</u>
≤1	Susceptible (S)

* Interpretative criteria applicable only to tests performed by broth microdilution method using cation-adjusted Mueller-Hinton broth with 2 to 5% lysed horse blood¹.

The current absence of data on resistant strains precludes defining any categories other than “Susceptible”.

Strains yielding MIC results suggestive of a “nonsusceptible” category should be submitted to a reference laboratory for further testing.

A report of “Susceptible” indicates that the pathogen is likely to be inhibited if the antimicrobial compound in the blood reaches the concentrations usually achievable. A report of “Intermediate” indicates that the result should be considered equivocal, and, if the microorganism is not fully susceptible to alternative, clinically feasible drugs, the test should be repeated. This category implies possible clinical applicability in body sites where the drug is physiologically concentrated or in situations where high dosage of drug can be used. This category also provides a buffer zone which prevents small uncontrolled technical factors from causing major discrepancies in interpretation. A report of “Resistant” indicates that the pathogen is not likely to be inhibited if the antimicrobial compound in the blood reaches the concentrations usually achievable; other therapy should be selected. Standardized susceptibility test procedures require the use of laboratory control microorganisms to control the technical aspects of the laboratory procedures. Standard vancomycin powder should provide the following MIC values:

<u>Microorganism</u>	<u>ATCC #</u>	<u>MIC (mcg/mL)</u>
<i>Enterococcus faecalis</i>	29212	1-4
<i>Staphylococcus aureus</i>	29213	0.5-2
<i>Streptococcus pneumoniae</i> *	49619	0.12-0.5

* Interpretative criteria applicable only to tests performed by broth microdilution method using cation-adjusted Mueller-Hinton broth with 2 to 5% lysed horse blood¹.

Diffusion Techniques

Quantitative methods that require measurement of zone diameters also provide reproducible estimates of the susceptibility of bacteria to antimicrobial compounds. One such standardized procedure² requires the use of standardized inoculum concentrations. This procedure uses paper disks impregnated with 30 mcg of vancomycin to test the susceptibility of microorganisms to vancomycin.

Reports from the laboratory providing results of the standard single-disk susceptibility test with a 30 mcg vancomycin disk should be interpreted according to the following criteria:

For testing aerobic microorganisms other than enterococci and streptococci:

<u>Zone Diameter (mm)</u>	<u>Interpretation</u>
≥15	Susceptible (S)
-	Intermediate (I)
-	Resistant (R)

For testing enterococci^{*+}:

<u>Zone Diameter (mm)</u>	<u>Interpretation</u>
≥17	Susceptible (S)
15-16	Intermediate (I)
≤14	Resistant (R)

* A direct nitrocefin-base β-lactamase test using direct colony growth should be performed to detect either ampicillin or penicillin resistance among enterococci due to β-lactamase production.

+ When testing for enterococci resistance to vancomycin, plates should be held for a full 24 hours and examined using transmitted light. The presence of a haze or any growth within the zone of inhibition indicates resistance. Those enterococci with intermediate zones of inhibition should be tested by a standardized procedure based on a dilution method¹ (broth or agar) or equivalent.

For testing streptococci* other than *Streptococcus pneumoniae*:

<u>Zone Diameter (mm)</u>	<u>Interpretation</u>
≥17	Susceptible (S)

*Interpretative criteria applicable only to tests performed by disk diffusion method using Mueller-Hinton agar with 5% defibrinated sheep blood and incubated in 5% CO₂².

The current absence of data on resistant strains precludes defining any categories other than “Susceptible”. Strains yielding zone diameter results suggestive of a “nonsusceptible” category should be submitted to a reference laboratory for further testing.

Interpretation should be as stated above for results using dilution techniques. Interpretation involves correlation of the diameter obtained in the disk test with the MIC for vancomycin.

As with standardized dilution techniques, diffusion methods require the use of laboratory control microorganisms that are used to control the technical aspects of the laboratory procedures. For the diffusion technique, the 30 mcg vancomycin disk should provide the following zone diameters in these laboratory test quality control strains:

<u>Microorganism</u>	<u>ATCC #</u>	<u>Zone Diameter (mm)</u>
<i>Staphylococcus aureus</i>	25923	17-21
<i>Streptococcus pneumoniae</i> [*]	49619	20-27

* Interpretative criteria applicable only to tests performed by disk diffusion method using Mueller-Hinton agar with 5% defibrinated sheep blood and incubated in 5% CO₂².

INDICATIONS AND USAGE

Vancomycin is indicated for the treatment of serious or severe infections caused by susceptible strains of methicillin-resistant (beta-lactam-resistant) staphylococci. It is indicated for penicillin-

allergic patients, for patients who cannot receive or who have failed to respond to other drugs, including the penicillins or cephalosporins, and for infections caused by vancomycin-susceptible organisms that are resistant to other antimicrobial drugs. Sterile Vancomycin Hydrochloride, USP is indicated for initial therapy when methicillin-resistant staphylococci are suspected, but after susceptibility data are available, therapy should be adjusted accordingly.

Vancomycin is effective in the treatment of staphylococcal endocarditis. Its effectiveness has been documented in other infections due to staphylococci, including septicemia, bone infections, lower respiratory tract infections, and skin and skin-structure infections. When staphylococcal infections are localized and purulent, antibiotics are used as adjuncts to appropriate surgical measures.

Sterile Vancomycin Hydrochloride, USP has been reported to be effective alone or in combination with an aminoglycoside for endocarditis caused by *Streptococci viridans* or *S. bovis*. For endocarditis caused by enterococci (e.g., *E. faecalis*), Sterile Vancomycin Hydrochloride, USP has been reported to be effective only in combination with an aminoglycoside.

Vancomycin has been reported to be effective for the treatment of diphtheroid endocarditis. Vancomycin has been used successfully in combination with either rifampin, an aminoglycoside, or both in early-onset prosthetic valve endocarditis caused by *S. epidermidis* or diphtheroids.

Specimens for bacteriologic cultures should be obtained in order to isolate and identify causative organisms and to determine their susceptibilities to Sterile Vancomycin Hydrochloride, USP.

To reduce the development of drug-resistant bacteria and maintain the effectiveness vancomycin and other antibacterial drugs. Vancomycin should be used only to treat or prevent 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.

CONTRAINDICATIONS

Sterile Vancomycin Hydrochloride, USP is contraindicated in patients with known hypersensitivity to this antibiotic.

WARNINGS

Rapid bolus administration (e.g., over several minutes) may be associated with exaggerated hypotension, including shock and, rarely, cardiac arrest.

Vancomycin should be administered over a period of not less than 60 minutes to avoid rapid-infusion-related reactions. Stopping the infusion usually results in a prompt cessation of these reactions.

Ototoxicity has occurred in patients receiving vancomycin. It may be transient or permanent. It has been reported mostly in patients who have been given excessive doses, who have an underlying hearing loss, or who are receiving concomitant therapy with another ototoxic agent, such as an aminoglycoside. Vancomycin should be used with caution in patients with renal insufficiency because the risk of toxicity is appreciably increased by high, prolonged blood concentrations.

Dosage of vancomycin must be adjusted for patients with renal dysfunction (see **PRECAUTIONS** and **DOSAGE AND ADMINISTRATION**).

Clostridium difficile associated diarrhea (CDAD) has been reported with use of nearly all antibacterial agents including Sterile Vancomycin Hydrochloride, USP and may range in severity from mild diarrhea to fatal colitis.

Treatment with antibacterial agents alters the normal flora of the colon leading to overgrowth of *C. difficile*.

C. difficile produces toxins A and B which contribute to the development of CDAD. Hypertoxin producing strains of *C. difficile* cause increased morbidity and mortality, as these infections can be refractory to antimicrobial therapy and may require colectomy. CDAD must be considered in all patients who present with diarrhea following antibiotic use. Careful medical history is necessary since CDAD has been reported to occur over two months after the administration of antibacterial agents.

If CDAD is suspected or confirmed, ongoing antibiotic use not directed against *C. difficile* may need to be discontinued. Appropriate fluid and electrolyte management, protein supplementation, antibiotic treatment of *C. difficile*, and surgical evaluation should be instituted as clinically indicated.

PRECAUTIONS

General

Prolonged use of vancomycin may result in the overgrowth of nonsusceptible microorganisms. Careful observation of the patient is essential. If superinfection occurs during therapy, appropriate measures should be taken. In rare instances, there have been reports of pseudomembranous colitis due to *C. difficile* developing in patients who received intravenous vancomycin.

In order to minimize the risk of nephrotoxicity when treating patients with underlying renal dysfunction or patients receiving concomitant therapy with an aminoglycoside, serial monitoring of renal function should be performed and particular care should be taken in following appropriate dosing schedules (see **DOSAGE AND ADMINISTRATION**).

Serial tests of auditory function may be helpful in order to minimize the risk of ototoxicity.

Reversible neutropenia has been reported in patients receiving vancomycin (see **ADVERSE REACTIONS**). Patients who will undergo prolonged therapy with vancomycin or those who are receiving concomitant drugs which may cause neutropenia should have periodic monitoring of the leukocyte count.

Vancomycin is irritating to tissue and must be given by a secure intravenous route of administration. Pain, tenderness, and necrosis occur with inadvertent extravasation. Thrombophlebitis may occur, the frequency and severity of which can be minimized by slow infusion of the drug and by rotation venous access sites.

There have been reports that the frequency of infusion-related events (including hypotension, flushing, erythema, urticaria, and pruritus) increases with the concomitant administration of anesthetic agents. Infusion-related events may be minimized by the administration of Sterile Vancomycin Hydrochloride, USP as a 60-minute infusion prior to anesthetic induction.

The safety and efficacy of vancomycin administration by the intrathecal (intralumbar or intraventricular) route or by the intraperitoneal route have not been established by adequate and well-controlled trials.

Reports have revealed that administration of sterile vancomycin by the intraperitoneal route during continuous ambulatory peritoneal dialysis (CAPD) has resulted in a syndrome of chemical peritonitis. To date, this syndrome has ranged from cloudy dialysate alone to a cloudy dialysate

accompanied by variable degrees of abdominal pain and fever. This syndrome appears to be short-lived after discontinuation of intraperitoneal vancomycin.

Prescribing vancomycin in the absence of a proven or strongly suspected bacterial infection or a prophylactic indication is unlikely to provide benefit to the patient and increases the risk of the development of drug-resistant bacteria.

Drug Interactions

Concomitant administration of vancomycin and anesthetic agents has been associated with erythema and histamine-like flushing (see **Pediatric Use** under **PRECAUTIONS**) and anaphylactoid reactions (see **ADVERSE REACTIONS**).

Concurrent and/or sequential systemic or topical use of other potentially, neurotoxic and/or nephrotoxic drugs, such as amphotericin B, aminoglycosides, bacitracin, polymixin B, colistin, viomycin, or cisplatin, when indicated requires careful monitoring.

Pregnancy:

Teratogenic Effects

Pregnancy Category C

Animal reproduction studies have not been conducted with vancomycin. It is not known whether vancomycin can affect reproduction capacity. In a controlled clinical study, the potential ototoxic and nephrotoxic effects of vancomycin on infants were evaluated when the drug was administered to pregnant women for serious staphylococcal infections complicating intravenous drug abuse. Vancomycin was found in cord blood. No sensorineural hearing loss or nephrotoxicity attributable to vancomycin was noted. One infant whose mother received vancomycin in the third trimester experienced conductive hearing loss that was not attributed to the administration of vancomycin. Because the number of patients treated in this study was limited and Sterile Vancomycin Hydrochloride, USP was administered only in the second and third trimesters, it is not known whether vancomycin causes fetal harm. Vancomycin should be given to a pregnant woman only if clearly needed.

Nursing Mothers

Vancomycin is excreted in human milk. Caution should be exercised when vancomycin is administered to a nursing woman. Because of the potential for adverse events, a decision should be made whether to discontinue nursing or discontinue the drug, taking into account the importance of the drug to the mother.

Pediatric Use

In pediatric patients, it may be appropriate to confirm desired vancomycin serum concentrations. Concomitant administration of vancomycin and anesthetic agents has been associated with erythema and histamine-like flushing in pediatric patients (see **ADVERSE REACTIONS**). The potential for toxic effects in pediatric patients from chemicals that may leach from the plastic containers into the single-dose, premixed intravenous preparation has not been determined.

Geriatric Use

The natural decrement of glomerular filtration with increasing age may lead to elevated vancomycin serum concentrations if dosage is not adjusted. Vancomycin dosage schedules should be adjusted in elderly patients (see **DOSAGE AND ADMINISTRATION**).

Information for Patients

Patients should be counseled that antibacterial drugs including vancomycin, should only be used to treat bacterial infections. They do not treat viral infections (e.g., the common cold). When vancomycin is prescribed to treat a bacterial infection, patients should be told that although it is common to feel better early in the course of therapy, the medication should be taken exactly as

directed. Skipping doses or not completing the full course of therapy may (1) decrease the effectiveness of the immediate treatment and (2) increase the likelihood that bacteria will develop resistance and will not be treatable by vancomycin or other antibacterial drugs in the future.

Diarrhea is a common problem caused by antibiotics which usually ends when the antibiotic is discontinued. Sometimes after starting treatment with antibiotics, patients can develop watery and bloody stools (with or without stomach cramps and fever) even as late as two or more months after having taken the last dose of the antibiotic. If this occurs, patients should contact their physician as soon as possible.

ADVERSE REACTIONS

Infusion-Related Events

During or soon after rapid infusion of vancomycin, patients may develop anaphylactoid reactions, including hypotension (see *ANIMAL PHARMACOLOGY*), wheezing, dyspnea, urticaria, or pruritus. Rapid infusion may also cause flushing of the upper body (“red neck”) or pain and muscle spasm of the chest and back. These reactions usually resolve within 20 minutes but may persist for several hours. Such events are infrequent if Sterile Vancomycin Hydrochloride, USP is given by a slow infusion over 60 minutes. In studies of normal volunteers, infusion-related events did not occur when Sterile Vancomycin Hydrochloride, USP was administered at a rate of 10 mg/min or less.

Nephrotoxicity

Renal failure, principally manifested by increased serum creatinine or BUN concentrations, especially in patients given large doses of Sterile Vancomycin Hydrochloride, USP has been reported rarely. Cases of interstitial nephritis have also been reported rarely. Most of these have occurred in patients who were given aminoglycosides concomitantly or who have preexisting kidney dysfunction. When Sterile Vancomycin Hydrochloride, USP was discontinued, azotemia resolved in most patients.

Gastrointestinal

Onset of pseudomembranous colitis symptoms may occur during or after antibiotic treatment (see *WARNINGS*).

Ototoxicity

A few dozen cases of hearing loss associated with Sterile Vancomycin Hydrochloride, USP have been reported. Most of these patients had kidney dysfunction or a preexisting hearing loss or were receiving concomitant treatment with an ototoxic drug. Vertigo, dizziness and tinnitus have been reported rarely.

Hematopoietic

Reversible neutropenia, usually starting one week or more after onset of therapy with Sterile Vancomycin Hydrochloride, USP or after a total dosage of more than 25 g, has been reported for several dozen patients. Neutropenia appears to be promptly reversible when Sterile Vancomycin Hydrochloride, USP is discontinued. Thrombocytopenia has rarely been reported. Although a causal relationship has not been established, reversible agranulocytosis (granulocytes $<500/\text{mm}^3$) has been reported rarely.

Phlebitis

Inflammation at the injection site has been reported.

Miscellaneous

Infrequently, patients have been reported to have had anaphylaxis, drug fever, nausea, chills, eosinophilia, rashes (including exfoliative dermatitis), linear IgA bullous dermatosis, Stevens-

Johnson syndrome, toxic epidermal necrolysis and vasculitis in association with the administration of Sterile Vancomycin Hydrochloride, USP.

Chemical peritonitis has been reported following intraperitoneal administration of Sterile Vancomycin Hydrochloride, USP (see **PRECAUTIONS**).

Post Marketing Reports

The following adverse reactions have been identified during post-approval use of vancomycin.

Because these reactions are reported voluntarily from a population of uncertain size, it is not possible to reliably estimate their frequency or establish a causal relationship to the drug exposure.

Skin and Subcutaneous Tissue Disorders

Drug Rash with Eosinophilia and Systemic Symptoms (DRESS)

OVERDOSAGE

Supportive care is advised, with maintenance of glomerular filtration. Vancomycin is poorly removed by dialysis.

Hemofiltration and hemoperfusion with polysulfone resin have been reported to result in increased vancomycin clearance. The median lethal intravenous dose is 319 mg/kg in rats and 400 mg/kg in mice.

To obtain up-to-date information about the treatment of overdose, a good resource is your certified Regional Poison Control Center. Telephone numbers of certified poison control centers are listed in the Physicians' Desk Reference (PDR). In managing overdose, consider the possibility of multiple drug overdoses, interaction among drugs and unusual drug kinetics in your patient.

DOSAGE AND ADMINISTRATION

This Pharmacy Bulk Package is intended for Intravenous use only.

Infusion-related events are related to both the concentration and the rate of administration of vancomycin. Concentrations of no more than 5 mg/mL and rates of no more than 10 mg/min are recommended in adults (see also age-specific recommendations). In selected patients in need of fluid restriction, a concentration up to 10 mg/mL may be used; use of such higher concentrations may increase the risk of infusion-related events. Infusion-related events may occur, however, at any rate or concentration.

Patients with Normal Renal Function

Adults

The usual daily intravenous dose is 2 g divided either as 500 mg every six hours or 1 g every 12 hours. Each dose should be administered at no more than 10 mg/min, or over a period of at least 60 minutes, whichever is longer. Other patient factors, such as age or obesity, may call for modification of the usual intravenous daily dose.

Pediatric Patients

The usual intravenous dosage of vancomycin is 10 mg/kg per dose given every 6 hours. Each dose should be administered over a period of at least 60 minutes. Close monitoring of serum concentrations of vancomycin may be warranted in these patients.

Neonates

In pediatric patients up to the age of 1 month, the total daily intravenous dosage may be lower. In neonates, an initial dose of 15 mg/kg is suggested, followed by 10 mg/kg every 12 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 administered over 60 minutes. In premature infants, vancomycin clearance

decreases as postconceptional age decreases. Therefore, longer dosing intervals may be necessary in premature infants. Close monitoring of serum concentrations of vancomycin may be warranted in these patients.

Patients with Impaired Renal Function and Elderly Patients

Dosage adjustment must be made in patients with impaired renal function. In the elderly, greater dosage reductions than expected may be necessary because of decreased renal function. Measurement of vancomycin serum concentrations can be helpful in optimizing therapy, especially in seriously ill patients with changing renal function. Vancomycin serum concentrations can be determined by use of microbiologic assay, radioimmunoassay, fluorescence polarization immunoassay, fluorescence immunoassay or high-pressure liquid chromatography.

If creatinine clearance can be measured or estimated accurately, the dosage for most patients with renal impairment can be calculated using the following table. The dosage of Sterile Vancomycin Hydrochloride, USP per day in mg is about 15 times the glomerular filtration rate in mL/min:

DOSAGE TABLE FOR VANCOMYCIN IN PATIENTS WITH IMPAIRED RENAL FUNCTION

(Adapted from Moellering et al.³)

Creatinine Clearance mL/min	Vancomycin Dose mg/24 hr
100	1,545
90	1,390
80	1,235
70	1,080
60	925
50	770
40	620
30	465
20	310
10	155

The initial dose should be no less than 15 mg/kg, even in patients with mild to moderate renal insufficiency.

The table is not valid for functionally anephric patients. For such patients, an initial dose of 15 mg/kg of body weight should be given to achieve prompt therapeutic serum concentrations. The dose required to maintain stable concentrations is 1.9 mg/kg/24 hr. In patients with marked renal impairment, it may be more convenient to give maintenance doses of 250 to 1000 mg once every several days rather than administering the drug on a daily basis. In anuria, a dose of 1000 mg every 7 to 10 days has been recommended.

When only the serum creatinine is known, the following formula (based on sex, weight, and age of the patient) may be used to calculate creatinine clearance. Calculated creatinine clearances (mL/min) are only estimates. The creatinine clearance should be measured promptly.

$$\text{Men: } \frac{\text{Weight (kg)} \times (140 - \text{age in years})}{72 \times \text{serum creatinine concentration (mg/dL)}}$$

Women: 0.85 x above value

The serum creatinine must represent a steady state of renal function. Otherwise, the estimated value for creatinine clearance will not be valid. Such a calculated clearance is an overestimate of actual clearance in patients with conditions:

- (1) characterized by decreasing renal function, such as shock, severe heart failure or oliguria;
- (2) in which a normal relationship between muscle mass and total body weight is not present, such as in obese patients or those with liver disease, edema or ascites; and
- (3) accompanied by debilitation, malnutrition or inactivity.

The safety and efficacy of vancomycin administration by the intrathecal (intralumbar or intraventricular) route have not been established.

Intermittent infusion is the recommended method of administration.

Compatibility with Other Drugs and IV Fluids

The following diluents are physically and chemically compatible (with 4 g/L vancomycin hydrochloride):

- 5% Dextrose Injection, USP
- 5% Dextrose Injection and 0.9% Sodium Chloride Injection, USP
- Lactated Ringer's Injection, USP
- 5% Dextrose and Lactated Ringer's Injection
- Normosol[®]-M and 5% Dextrose
- 0.9% Sodium Chloride Injection, USP
- Isolyte[®] E

Good professional practice suggests that compounded admixtures should be administered as soon after preparation as is feasible.

Vancomycin solution has a low pH and may cause physical instability of other compounds.

DIRECTIONS FOR PROPER USE OF PHARMACY BULK PACKAGE:

Pharmacy Bulk Packages 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 **4 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 **4 hours** after initial closure puncture.

PREPARATION AND STABILITY

10 g Pharmacy Bulk Package

At the time of use, reconstitute by adding 95 mL of Sterile Water for Injection, USP to the 10 g Pharmacy Bulk Package of dry, sterile vancomycin powder. The resultant solution will contain

vancomycin equivalent to 500 mg/5 mL or 1 g/10 mL. **RECONSTITUTED BULK SOLUTION SHOULD NOT BE USED FOR DIRECT INFUSION.**

Reconstituted solutions of vancomycin (500 mg/5 mL) must be further diluted with at least 100 mL of a suitable infusion solution. For doses of 1 gram (10 mL), at least 200 mL of solution must be used. The desired dose diluted in this manner should be administered by intermittent IV infusion over a period of at least 60 minutes.

Parenteral drug products should be visually inspected for particulate matter and discoloration prior to administration, whenever solution and container permit.

HOW SUPPLIED

Product No.	NDC No.	
6510	0409-6510-01	Sterile Vancomycin Hydrochloride, USP equivalent to 10 grams vancomycin in a <i>Pharmacy Bulk Package</i> , (bottle capacity 100 mL), packaged individually

Prior to reconstitution, store dry powder at 20 to 25°C (68 to 77°F). [See USP Controlled Room Temperature.]

ANIMAL PHARMACOLOGY

In animal studies, hypotension and bradycardia occurred in dogs receiving an intravenous infusion of vancomycin hydrochloride, 25 mg/kg, at a concentration of 25 mg/mL and an infusion rate of 13.3 mL/min.

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