



von Willebrand Disease

Diagnosis and Treatment in the Home Care Setting

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Continuing Education Objectives

After reading this monograph, the participant should be able to:

1. Describe the symptoms and basic mechanism of action of von Willebrand disease (vWD)
2. Understand how vWD is diagnosed
3. Compare and contrast the three different Types of vWD
4. Understand the key clinical manifestations of vWD
5. Understand the function of the von Willebrand factor (VWF)
6. List the treatment options for vWD based upon Type and severity
7. Understand the treatment goals for vWD
8. Describe which classes of medications are used in the treatment of vWD
9. Understand the differences in dosing factor products for vWD
10. Understand the role of home infusion and specialty pharmacy providers in the care and management of vWD patients





In 1926, Dr. Erik von Willebrand, a Finnish internist, first reported on a bleeding disorder that affected 23 out of 66 family members living on the Aland Islands between Finland and Sweden. The family had severe bleeding tendencies, and three of four children died due to hemorrhaging before age four. The index case was a five-year-old female with severe mucotaneous bleeding who bled to death at age 13 at the onset of menarche. Although he initially called the disease “pseudohemophilia,” von Willebrand noted that this disease was clearly different from hemophilia due to its autosomal pattern of inheritance, and that the disorder affected both men and women.¹

von Willebrand disease (vWD) is the most common inherited coagulation disorder in humans, occurring in one to two percent of the general population, or approximately three million individuals in the United States. It affects people of all ethnic backgrounds. More than two-thirds of individuals with vWD are asymptomatic or mildly symptomatic.²

vWD is caused by a lack of or defect in the von Willebrand factor (VWF), a blood protein that initiates the first step in the coagulation process.³ VWF is one of the largest proteins in the blood and is composed of a large number of protein sequences that form multimers (chains) of varying lengths and molecular weight. VWF promotes adhesion of platelets to the sites of vascular injury via an interaction with platelet glycoprotein Ib (GP1b). Additionally, VWF facilitates the transportation of factor VIII to the site of vascular injury (see Exhibit 1).⁴

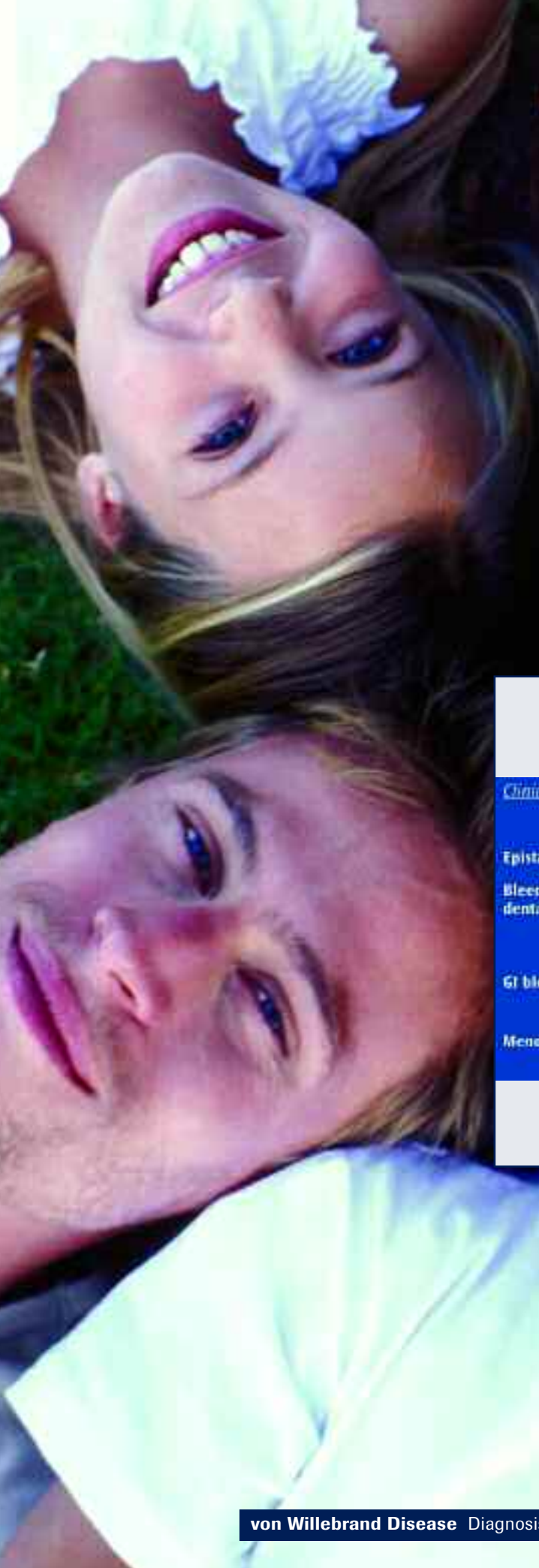
Exhibit 1

FUNCTIONS OF THE VWF MOLECULE



- * Facilitate platelet plug formation
- * Stabilize FVIII:C

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Clinical Manifestations of vWD

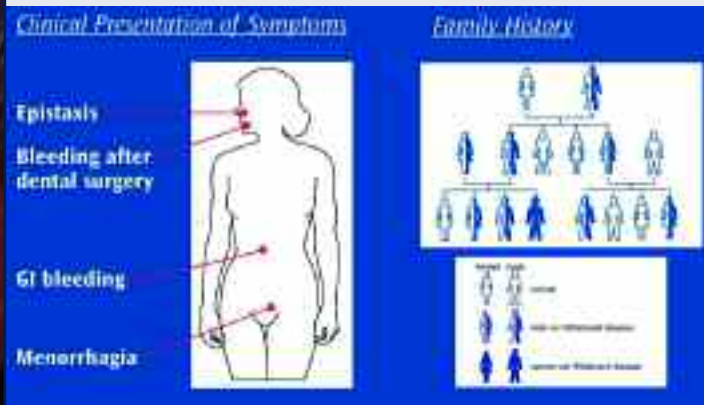
vWD is characterized by variable mucosal bleeding particularly in the mouth, nose, throat, GI tract, and skin surfaces. Menorrhagia and post-partum hemorrhage are often the only presenting symptoms and can be quite severe.^{3,5} There are four key clinical manifestations of vWD:

- * Easy bruising
- * Menorrhagia
- * Frequent or prolonged nosebleeds (epitaxis)
- * Prolonged bleeding following dental work (bleeding gums), surgery, childbirth or injury

Sometimes bleeding is caused by injury, other times there is no obvious cause. In most cases, vWD is a mild disorder with relatively few if any symptoms, which is why the disease is highly undiagnosed. Many individuals do not realize that they have the disease until another family member is diagnosed or surgery or major physical trauma occurs.

Exhibit 2

FAMILY HISTORY



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Diagnosis

Diagnosis is based on patient symptoms and family history since most cases follow an autosomal dominant pattern of inheritance (see Exhibit 2). However, spontaneous genetic mutations of vWD can occur in approximately 30 percent of all cases.

Initial screening for a bleeding disorder starts with a series of coagulation tests consisting of:

- * Complete Blood Count (CBC), particularly hemoglobin
- * Platelet Count

- * Bleeding Time (BT)
- * Prothrombin Time (PT) – evaluates plasma clotting factors I, II, V, VII, and X, however, vWD does not involve any of these clotting factors
- * Activated Partial Thromboplastin Time (aPTT) – evaluates clotting factors I, II, V, VII, IX, X, XI, and XII. Of these, only factor VIII is involved

Individuals with vWD may have a normal PT, unless they have very low levels of VIII. aPTT may also be normal in vWD, and thus can result in false negatives in many patients. These basic coagulation tests are generally inadequate for detecting mild forms of vWD. If an individual's personal and family histories are strong enough to indicate a potential vWD diagnosis, additional diagnostic labs should be ordered.

The standard vWD laboratory workup consists of:⁶

- * **VWF Antigen (VWF:Ag).** An immunoassay that measures the total amount of VWF present. Normal ranges are 50 to 200 I/dl.
- * **von Willebrand Ristocetin Cofactor (WF:RCoF).** A functional bioassay of VWF, which measures the ability of a patient's blood to support agglutination of normal platelets in the presence of ristocetin, thus, measuring VWF function. Normal ranges are 50 to 200 μ/dl.
- * **VWF Multimer Analysis.** Measures the quantity and molecular structure of the VWF molecule. Analysis of the VWF multimers is necessary to ensure an accurate classification of the disease.
- * **Ristocetin-Induced Platelet Aggregation (RIPA).** Useful in distinguishing Type 2B from 2A vWD.

Lab Test Variability

Since vWD is highly variable, the diagnostic tests may need to be repeated several times in individuals in order to accurately diagnosis the disease. Additionally, there is a high degree of lab test variability that may cause false negatives. Fluctuating VWF levels are often seen with: stress, pregnancy, estrogen therapy, cold temperatures, inflammation, exercise, infection, and blood Type. Several of these variables affect VWF levels by releasing adrenaline from the stored sites within the blood vessel endothelium—which in turn, releases stored levels of VWF.⁷⁻⁹ Additionally, individuals with Type O blood naturally have lower levels of VWF than people with other blood Types, independent of whether or not they have vWD.⁹

Drugs and foods that affect platelet function can also mask the vWD diagnosis and may include (but are not lim-





ited to): aspirin, NSAIDs, guaifenesin, quinine and penicillin, fish high in omega-3 fatty acids, vitamin E, and herbs such as ginkgo biloba, ginseng, and echinacea.^{7,8}

Determining the Type of vWD

Disease severity and treatment depend on the Type of vWD. The disease is classified based upon VWF multimer differentiation or abnormal multimers. Referral to a bleeding disorder hematologist (as opposed to a hematologist-oncologist) affiliated with one of the national hemophilia treatment centers (HTCs) is imperative in accurately diagnosing vWD.

vWD is classified into three Types as follows:^{7,10}

- * **Type 1.** The most common and mildest form of vWD, which involves a quantitative defect of VWF. The VWF functions normally, but levels are reduced to 20 to 50 percent of normal values, thus, a wide range of severities can be seen. Approximately 70 to 80 percent of patients with vWD have Type 1.¹⁰
- * **Type 2.** This Type involves a qualitative defect in the VWF and affects 15 to 20 percent of patients with vWD. Unlike Type 1 patients, Type 2 vWD patients produce normal levels of VWF; however, their VWF is structurally and functionally dysfunctional. Type 2 vWD is further classified into the following four subgroups:
 - ⚙️ **Type 2A.** Patients do not have a sufficient quantity of high molecular weight multimers, which results in a loss of platelet adhesion.
 - ⚙️ **Type 2B.** The VWF that patients have is defective causing an increase in platelet aggregation, which leads to low platelet counts. Patients lack medium to high VWF multimers.
 - ⚙️ **Type 2M.** Not associated with multimer defects. Similar to Type 2B, but with decreased platelet-

function and absence of high-molecular weight multimers.

- ⚙️ **Type 2N.** Similar to mild hemophilia A with a defective binding of VWF for factor VIII.
- * **Type 3.** The rarest and most severe form of vWD. The incidence is one to three per million and is caused by an almost complete absence of VWF. These individuals experience frequent, severe, life-threatening bleeds similar to individuals with hemophilia, and must be treated immediately.

Some individuals develop vWD later in life due to the formation of antibodies that attack and destroy the VWF. Acquired vWD is usually seen in individuals with underlying autoimmune disorders such as lupus, rheumatoid arthritis, and certain types of cancer. Additionally, certain drugs such as valproic acid and ciprofloxacin can induce vWD.¹¹

Treatment Options

Treatment goals for vWD include correcting the patient's bleeding time and coagulation abnormality. These treatment goals can be achieved via infusing the missing VWF complex, or using desmopressin acetate (DDAVP, either intranasally or intravenously) as well as using various adjunctive therapies.³ Following is a summary of vWD treatment options:

- * **Desmopressin Acetate (DDAVP).** DDAVP causes the release of VWF and factor VIII from storage sites within the endothelium of the blood vessels. DDAVP is indicated for Type 1 vWD and mild hemophilia A, some Type 2A, but is not indicated for Types 2 and Type 3 vWD. A test dose of DDAVP is usually given in a controlled medical setting. Dosage forms include a parenteral and intranasal form.

DDAVP is available as a highly concentrated (1.5 mg/ml) intranasal spray (Stimate®, ZLB Behring). Clinicians should take care not to dispense the generic DDAVP spray, as it is a much weaker concentration (0.1 mg/ml), which is indicated for diabetes insipidus and nocturnal enuresis. Generic DDAVP nasal spray will not stop bleeding. DDAVP dosages are summarized in Exhibit 3. Side effects include flushing, hyponatremia, headaches, dizziness, and palpitations that are related to the release of adrenaline.

- * **Factor Concentrates.** Factor concentrates work by raising the plasma levels of VWF and factor VIII. Factor concentrates are indicated for individuals with Types 2A, 2B, and 3. Clotting factor may also be used in individuals with Type 1 vWD prior to surgery or injury.

Antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring) is the only FDA-approved factor product for treating vWD. Antihemophilic factor [human] (Koate-DVI®, Bayer Corp.) and Antihemophilic factor [human] (Alphanate®, Grifols) are also used off-label. Home infusion and specialty pharmacy staff should ensure that the patient has reimbursement coverage for products used off-label. All three of these products are plasma derived; there is no recombinant form of VWF. As such, these products all carry the risk of viral/pathogen transmission.

Humate-P® is labeled in both factor VIII and RCoF units; they are not equivalent. Humate-P® contains two units of RCoF for every one unit of factor VIII. For patients with vWD, clotting factor is prescribed in RCoF units. Always use caution and verify the type of units prescribed with the patient's physician. The prescribed quantity of factor will also vary depending on the Type of vWD the patient has as well as the severity of the bleeding episode. Consult the product package insert for exact dosing calculations.¹³

- * **Antifibrinolytics.** Antifibrinolytics are useful agents for the treatment of mucosal bleeds in the mouth, tongue, and nose. Digestive enzymes present in the saliva make the treatment of mouth bleeds difficult. Some hematologists also prescribe antifibrinolytics for menorrhagia--consult with prescriber for their particular menorrhagia protocols. A dosing summary for antifibrinolytics and adjunctive therapies used in the treatment of vWD are listed in Exhibit 3.

Exhibit 3

TREATMENT OPTIONS AND DOSAGES FOR VON WILLEBRAND DISEASE (vWD)

Desmopressin Acetate (DDAVP)

- * IV: 0.3 mcg/kg in 25 – 50 ml 0.9% sodium chloride over 30 minutes. May be given subcutaneously without the addition of NS.
- * Intranasal: Use highly concentrated (1.5 mg/ml) DDAVP nasal spray (Stimate®, ZLB Behring). For patients <50 kg, one puff (150 mcg). For individuals weighing greater than 50 kg, one spray in each nostril (300 mcg).¹²

VWF/Factor VIII Concentrates^{6, 13}

- * Antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring): Only FDA-approved factor concentrate for vWD. Dose will vary by patient's weight and type of hemorrhagic incident. Usual dosing guide:

$$\text{RCoF Dose (IU)} = \frac{\text{Body Weight (kg)} \times \text{\% Target increase in VWF plasma level}}{1.5 \text{ Recovery Rate}^6}$$

Antifibrinolytics^{3,6}

- * Aminocaproic Acid (Amicar®, Xanodyne): Available as 500 mg tablets and a 250mg/ml liquid
IV: 50 to 100 mg/kg
Orally: Every 6 to 12 hours followed by maintenance doses of 100 mg/kg every 6 hours for 3 – 7 days, maximum of 6 gm/ dose
- * Tranexamic acid (Brand name TBA, Xanodyne): Available in tablets and IV. Note: Not currently available in the U.S., approval process underway
Orally: 25 mg/kg, every 6-8 hours for 3 – 7 days

**Both medications can be used as a mouthwash, dilute 10% IV solution with NS.*

Adjunctive Therapies

- * Oral contraceptives: to control menorrhagia
- * Progesterone IUD
- * Topical hemostatic agents: topical thrombin, liquid Band-Aid® (Johnson & Johnson), Nosebleed QR™ (Biolife), UrgentQR™ (Biolife)
- * Topical neosynephrine: for nosebleeds

Conclusion

Once properly diagnosed and treated, people with vWD can lead normal and productive lives. Oftentimes, complications arise because the individual doesn't realize that he or she has vWD until surgery or major trauma occurs.

To address this public health concern, several vWD public awareness initiatives have been launched by the Centers for Disease Control (CDC) and the National Hemophilia Foundation (NHF) to spread knowledge of and to encourage testing for vWD. Additional resources for vWD are listed in Exhibit 4.

Exhibit 4

VON WILLEBRAND DISEASE RESOURCES

- * von Willebrand Disease: Just the FAQs (Frequently Asked Questions). 2000, NHF.
- * Williams, J. *A Guide to Woman and Girls with Bleeding Disorders*. 1998, NHF.
- * www.allaboutbleeding.com/vwd_and_you
- * The CDC Program—Bleeding Disorders and Women, <http://www.cdc.gov/ncbddd/hbd/documents/hemaware0103.pdf>
- * National Hemophilia Foundation's 'Project Red Flag' <http://www.projectredflag.org/index.htm>.
- * Paper, R. *A Guide to Living with von Willebrand Disease*. Available through ZLB Behring: 888.508.6978
- * National Head, Lung, and Blood Institute Diseases Index, <http://www.nhlbi.nih.gov/health/dci/index.html>

VON WILLEBRAND DISEASE CASE STUDY

Patient S.L. is a 26-year-old female diagnosed with Type 1 vWD in 2001. She has a life-long history of menorrhagia, nose bleeds, and excessive gum bleeds. She has two children. The patient underwent back surgery, (fusion of L4/5 and S1) in February 2003 and required IV antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring) pre-operatively.

S.L. tolerated surgery well with only minimal bleeding. Post operatively, she continued to receive antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring) via a peripherally inserted central catheter (PICC). Several weeks after surgery, S.L. experienced bleeds along the muscles near her surgical sites, which caused syncope, resulting in falls and other injuries.

During 2003, S.L. continued to have severe bleeds in her back and now required daily infusions of antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring), 4,000 RCoF/dose. S.L.'s dose was eventually decreased to 4,000 RCoF units prophylactically, every Monday, Wednesday, and Friday. For the prophylactic regimen, S.L.'s PICC line was removed and she was taught how to self-infuse via a peripheral vascular access device (butterfly). After eight months, S.L. was weaned off of antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring) prophylaxis.

Two months after discontinuing prophylactic dosing, S.L. experienced a back bleed, which required daily infusions of antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring). After several weeks, her back and muscle bleeds subsided and she did not require replacement factor therapy for several months. During June 2004,

S.L. started to have unusually heavy bleeding with prolonged menses resulting in severe anemia (hemoglobin at this time was 8). Her hematologist prescribed rFactorVIIa (NovoSeven®, Novo Nordisk), 1.2 mcg, IV prn excessive menorrhagia to prevent anemia

S.L.'s current medication regimen consists of:

- * Antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring), 4,000 RCoF units/dose prn bleeds
- * Desmopressin acetate (Stimate®, ZLB Behring), 1 spray each nostril, every other day
- * Tranexamic acid (Cyklokapron®, Pfizer), 100 mg/ml, 4 gm by mouth during menses
- * rFactorVIIa (NovoSeven®, Novo Nordisk), 1.2 mg, IV prn excessive bleeding and menorrhagia

rFactorVIIa (NovoSeven®, Novo Nordisk) was added as adequate hemostasis was not achieved with antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring) alone. rFactorVIIa (NovoSeven®, Novo Nordisk) induces hemostasis by activating Factor X to Xa, which activates the clotting cascade to ultimately convert prothrombin to thrombin, which leads to the formation of a hemostatic plug via the conversion of fibrinogen to fibrin.¹⁴

S.L. has become proficient in her self-management of vWD particularly with her peripheral IV access for factor replacement therapy. Home infusion services included the provision of clotting factor and related ancillary supplies, as well as education and teaching materials for her therapies and disease process.



ABOUT THE AUTHOR

Hetty Lima, R.Ph., F.A.S.H.P., is Vice President of Chronic Infusion Services for Caremark Inc., in Northbrook, Illinois. She has more than 23 years of alternate site/specialty pharmacy experience and is a past President of the American Society of Health Systems Pharmacists (ASHP) Section of Home Care Practitioners. Lima has lectured and published extensively on the clinical and practical aspects of home infusion and specialty pharmacy. Her work has appeared in numerous pharmacy/nursing journals. No strangers to von Willebrand Disease, Lima and her family all have vWD. She and her son, Benjamin, have Type 1 moderate severe vWD, her husband, Peter, has mild Type 1 vWD, and her youngest son, Nik, has Type 3 severe vWD.

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Continuing Education Assessment Questions

MARCH 2006
Expires MARCH 2009

1. Which statement is true regarding the diagnosis of von Willebrand disease (vWD)?
 - a. Diagnostic testing must often be repeated in order for an accurate diagnosis to be made
 - b. Diagnosis may be inaccurate and influenced by many factors
 - c. Diagnosis is confirmed by a series of complex tests that must be performed by specialized laboratories
 - d. All of the above
2. Which statement is true about vWD?
 - a. Type 3 is the most common form of vWD
 - b. Approximately 80 percent of all individuals with vWD have Type 1
 - c. 50 percent of vWD patients have Type 2
3. The treatment of choice for vWD patients with mild to moderate forms of Type 1 vWD is:
 - a. Vasopressin
 - b. Cryoprecipitate
 - c. DDAVP (high concentration)
 - d. Antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring)
4. Women with vWD typically have which of the following symptoms:
 - a. Excessive bleeding after childbirth
 - b. Menorrhagia
 - c. Excessive bruising and hemorrhaging after dental or surgical procedures
 - d. All of the above
5. Patients with Type 3 vWD:
 - a. Do not hemorrhage after dental or surgical procedures
 - b. Have severe hemorrhagic tendencies similar to those seen with hemophilia A
 - c. Both b & d
 - d. Can have frequent, life-threatening, spontaneous hemorrhage from mucous membranes, the GI tract, and joints
6. Which statement regarding hemorrhagic tendency in vWD is true?
 - a. It can be mild (e.g., nosebleeds, easy bruising)
 - b. It can be severe and life-threatening, similar to that seen in individuals with hemophilia
 - c. It can vary depending on the Type and severity of vWD
 - d. All of the above
7. Individuals with Type 2 vWD have:
 - a. A qualitative defect of VWF
 - b. A quantitative deficiency of VWF
 - c. Both a & d
 - d. VWF that is structurally dysfunctional
8. The treatment of choice for individuals with mild to moderate Type 1 vWD is:
 - a. Vasopressin
 - b. Cryoprecipitate
 - c. Antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring)
 - d. Concentrated DDAVP
9. Antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring) prescribed for vWD is expressed in Factor VIII units
 - a. True
 - b. False
10. Case study patient S.L. had Type 1 vWD and experienced severe post-surgical back bleeds. Choose the correct statement:
 - a. The drug of choice for treatment of Type 1 vWD is DDAVP nasal spray (Stimate®, ZLB Behring)
 - b. The drug of choice for treatment of Type 1 vWD is intranasal or intravenous/subcutaneous DDAVP (Stimate®, ZLB Behring)
 - c. Stimate® (ZLB Behring) is indicated for Type 1 vWD only
 - d. S.L.'s antihemophilic factor/von Willebrand factor complex (Humate-P®, ZLB Behring) dose was incorrect
 - e. None of the above
11. S.L. was given an antifibrinolytic agent to control her menorrhagia
 - a. True
 - b. False
12. rFactorVIIa (NovoSeven®, Novo Nordisk) is:
 - a. A recombinant VIIa clotting factor
 - b. Inappropriate to use in a patient with Type 1 vWD
 - c. Induces hemostasis by ultimately causing the conversion of fibrinogen to fibrin
 - d. Both a & b
 - e. Both a & c

Continuing Education Application

MARCH 2006
Expires **MARCH 2009**

To earn pharmacy continuing education credit: ACPE Program 207-999-06-027-H01

- A score of 70% is required to successfully complete the C.E. quiz. Failure to achieve a passing score will result in one free re-examination. Please allow at least four weeks for notification of scores and issuance of C.E. certificates.
- Record your quiz answers and the following information on this form
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Name _____
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Quiz: Shade In Your Choice

	A	B	C	D	E
1.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	<input type="checkbox"/>	<input type="checkbox"/>			
4.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	



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Circle your choice

- Is this program used to meet your mandatory C.E. requirements?
A. Yes B. No
- Job description
A. Owner B. Manager C. Employee
- Age Group
A. 21-30 B. 31-40
C. 41-50 D. 51-60 E. Over 60
- How long have you been practicing as a home infusion pharmacist?
A. 2 years or less B. 5 years or less
C. 10 years or less D. More than 10 years
- Did this module achieve its stated objectives?
A. Yes B. No
- How much of this program can you apply in practice?
A. All B. Some
C. Very little D. None
- How long did it take you to complete both the reading and the quiz? _____ minutes



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