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von Willebrand Disease

Hannah Smith
hs276009@yahoo.com

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Hannah Smith RN, BSN, CCRN
Otterbein University, Westerville, Ohio

Introduction

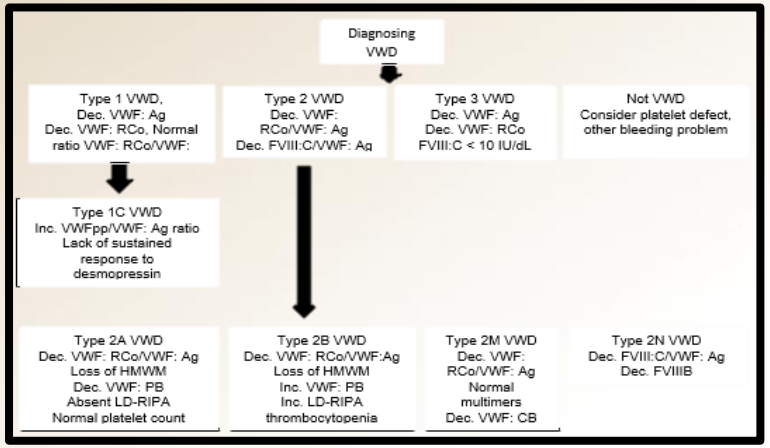
The topic to be discussed is von Willebrand disease. Von Willebrand disease is named after the scientist that discovered the disorder; Erik von Willebrand. von Willebrand disease (VWB) is one of the many types of bleeding disorders (Leebeek & Eikenboom, 2016, p. 2067). The disease is an autosomal inherited mutation and is the most common of the bleeding disorders. Von Willebrand factor's main functions are to bind to collagen sites during vascular injury, play a role in platelet adhesion and aggregation, and is a carrier protein for factor VIII. When von Willebrand factor is missing, depleted or malfunctioning symptoms of pathological bleeding occur. VWD varies in how the altered gene is expressed phenotypically. The disease is subdivided into categories based on severity and alteration of the Von Willebrand factor. Part of the range in symptoms and severity is in part because VWD can be a dominant or recessive inheritance pattern (Leebeek & Eikenboom, 2016, p. 2068). There is an array of VWD screening tests and confirmatory tests that would need to be done to not only diagnose VWD but also to determine which category, and therefore, severity the patient has (Roberts & Flood, 2015). This topic was chosen because this disease becomes a complication for patients who need surgery or are victims of trauma. The author is currently working in the post-anesthesia care unit at Grant Medical Center, which is also a level 1 trauma center. Special consideration needs to be given to this vulnerable population. Knowledge of this disease will also be helpful in any type of future practice setting.

Signs and Symptoms

- Hemophilic arthropathy: Most common joint affected is the knee leading to the need for a total knee arthroplasty. Chronic synovial inflammation and hemarthroses damage articular cartilage and cause severe arthritis even at a young age (Cancienne, Werner, & Browne, 2015, p. 2285).
- Heavy menstrual bleeding: Heavy menstrual bleeding (menorrhagia), especially during anovulation, menarche, and perimenopause. It is recommended that females age 10-17 that present with heavy menstrual bleeding be screened for VWD and other bleeding disorders (Khamees, Kima, & O'Brien, 2014, p. 195).
- Epistaxis and other mucosal bleeding (Abshire et al., 2015, p. 1585).
- Gastrointestinal bleeding/hemorrhage (Abshire et al., 2015, p. 1585).
- Excessive bleeding after surgery, trauma or childbirth: Hematomas and bleeding from minor wounds. Bleeding after dental extractions (Leebeek & Eikenboom, 2016, p. 2067).

Underlying Pathophysiology

- Inheritance patterns: The subtypes are VWD 1, VWD2A, VWD2B, VWD2M, VWD2N and VWD 3. VWD 1 is the mildest and VWD 3 is the most severe. VWD 1, VWD2B, VWD2M are an autosomal dominant inheritance pattern. VWD2N and VWD 3 are a recessive inheritance pattern and VWD2A can be both (Federici, 2016, p. 42). Type 3 VWD contains null alleles which results in the complete nonappearance on von Willebrand factor. Type 1 VWD has incomplete penetrance and involves defects in intracellular routing, storage, secretion and faster clearance of von Willebrand factor. Type 2 is fully penetrant and results in restriction of the von Willebrand factor protein (Leebeek & Eikenboom, 2016, p. 2071).
- Normal von Willebrand function: von Willebrand factor (VWF) is synthesized in the endothelial cells and is either secreted or stored within the endothelial cells where they are kept until they are stimulated. VWF contains amino acids that play a role in the structure or function of the molecule. VWF is made specifically in the endoplasmic reticulum of the cell where it becomes a large high molecular weight multimer that binds collagen and contains the platelet receptors GPIb and GPII/IIIa (Schneppenheim, 2011, p. 53-54).
- Subtype pathophysiology: The subtypes are classified as such do to their mechanism of action. VWD 1, the mildest form, has less than the normal amount of von Willebrand factor. VWD2A has decreased platelet adhesion. VWD2A loses its platelet adhesion because it loses its multimer shape and is no longer of high molecular weight. VWD2B has increased affinity for the platelet GPIb alpha. VWD2N decreases binding for factor VIII. Factor VIII is a protein that plays a role in the clotting cascade. Finally, VWD 3, the most severe, is complete loss of any VWF (Federici, 2016, table 1).



Significance of Pathophysiology

- Because there are so many subtypes treatment is not a one-size-fits-all problem to solve. The patient may present with vague bleeding symptoms or be in critical condition due to hypovolemic shock. Therefore, the caregiver must rule out and screen for any patient that increased bleeding is a part of the symptomology (Khamees et al., 2014).
- Von Willebrand disease seams to affect women more than men because of monthly menstrual bleeding. It is common for women to go undiagnosed and untreated. It is a goal of Healthy People 2020 to correct this problem. Therefore, women who present with heavy menstrual bleeding (hospitalization for menstrual bleeding, iron deficiency anemia or requiring a blood transfusion) be screened for VWD and receive treatment within a year of first bleeding episode (Khamees et al., 2014, p. 195-197).
- VWD has many different inheritance patterns. Type 3 (the most severe) usually happens when the gene is passed from the mother as well as the father. If the inheritance pattern is recessive, and neither parent phenotypically has the disease, then the child has a 25% chance on inheriting the severe form ("How von Willebrand is inherited," 2014, para. 1). Therefore, information about familial genetics is vital information for the caregiver.

Implications for nursing care

- When a patient presents with the signs and symptoms of von Willebrand disease the nurse practitioner should begin with a detailed history, especially a familial health history, and a physical exam. Preliminary laboratory tests include a platelet count, thyroid level, prothrombin time, activated partial thromboplastin time and a hemoglobin and hematocrit level (Brooks, Brooks, & Alvaro, 2016, p. 102).
- If these results come back as abnormal, if there is a familial history of bleeding disorders or any of the severe bleeding signs are present (see above) the patient should be screened for a bleeding disorder. VWD screening tests include VWF antigen (VWF:Ag), VWF ristocetin cofactor activity (VWF:RCo), factor VIII activity (FVIII:Cand VWF:RCo/VWF:Ag (Roberts & Flood, 2015, p. 12-13).
- Once a definitive diagnosis for VWD has been made the nurse practitioner should refer the patient to a hematologist. From there, treatment varies depending on the subtype of VWD the patient has. After the patient has received initial appropriate treatment and is stable the nurse practitioner can resume care of the patient to perform routine laboratory work and prescribe of medication (Brooks et al., 2016, p. 104).
- Type 1 VWD (and sometimes type 2) is commonly treated with desmopressin acetate (DDAVP). The use of this drug increases factor VIII and of VWF. The drug causes temporary vasoconstriction which elicits the endothelial cells to release clotting factors (Kauffman, 2014, p. 91).
- In type 3 and in the majority of type 2 patients factor replacement is necessary (Leebeek & Eikenboom, 2016, p. 2075-2076).
- Tranexamic acid and aminocaproic acid are fibrinolysis inhibitors can be given in a mouthwash form prophylactically to patients undergoing dental procedures (Leebeek & Eikenboom, 2016, p. 2077).
- Anti-platelets may be given to individuals with type 2B VWD due to the mutated GP-Ib-IX platelet receptor. The mutated receptor has a dysfunctional affinity for platelets making the VWF "tied up" with the platelets rather than being able to aid in the clot formation of a real vascular injury (Ware, 2013, p. 5004).
- Oral contraceptives can be given to women with symptoms of heavy menstrual cycles but special care must be taken as to not mask the symptoms before getting a definitive von Willebrand disease diagnoses (Brooks et al., 2016, p. 104).
- The nurse practitioner should be aware that the patient will have a higher risk for infection, medical complications, venous thromboembolism and blood transfusions following trauma or surgical procedures (Cancienne et al., 2015, p. 2286).
- Lastly the patient must be educated about the disease, new medications, how to care for oneself and given information about support groups, community resources and genetic counseling (Brooks et al., 2016, p. 102).

Conclusion

- Von Willebrand factor's function is to bind to collagen sites during vascular injury, play a role in platelet adhesion and aggregation, and is a carrier protein for factor VIII. Malfunction of this factor can cause bleeding symptoms. (Leebeek & Eikenboom, 2016).
- VWD can be inherited either autosomal dominant or recessive. ("How von Willebrand is inherited," 2014). The types and subtypes are determined by inheritance pattern and underlying pathophysiology. The mildest (type 1) is caused by insufficient VWF and the most severe (type 3) is complete absence of VWF (Federici, 2016).
- Diagnoses is made from a wide range of laboratory results that each type (and subtype) follow (Roberts & Flood, 2015).
- Treatment also varies based on the type of VWD diagnosed. DDAVP, anti-platelets and intravenous administered factor are all options. Despite treatment patients are at higher risk for infection and other complications following surgery or trauma (Leebeek & Eikenboom, 2016).

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