Cerebral Venous and Dural Sinus Thrombosis

Taylor Godfrey

Methodist University

Abstract

Cerebral venous dural sinus thrombosis is a rare form of stroke that is seen more often in women than in men. For every one millions patients seen each year, only three or four may actually have a form of a cerebral venous dural sinus thrombosis. There are three different forms of this thrombus and they are known as sinus thrombosis, cortical vein thrombosis, deep cerebral venous thrombosis. An individual may have thrombi in multiple portions of the brain in which causes the stroke type to overlap within the three categories. This paper is going to thoroughly describe the disorder and its pathophysiology to allow readers to understand why a cerebral venous dural sinus thrombosis is seen less often then the normal ischemic stoke. Risk factors, symptoms, diagnostic procedures, treatment, nursing care, and prevention including lifestyle modifications, will be described to educate readers on all aspects of the disorder and promote positive patient outcomes. The paper will include nursing diagnosis and interventions that were used for the actual patient who stimulated the research of CVST. There will also be an overview that describes the different types of research used to prepare the document and the use of the Orem’s Self-Care model to describe how prevention can occur by following the model. In this paper, the terms cerebral venous dural sinus thrombosis may also be replaced with CVST or cerebral venous sinus thrombosis. They can be used interchangeably.

***Keywords:***

Cerebral Venous Dural Sinus Thrombosis, Venous Sinus Thrombosis, Stroke, Cerebral Vascular Accident, Prothrombin Time, Brain Tumor, Orem’s Self-Care Model, Tissue Perfusion, Occlusion, Hemorrhage, Dysphagia, Hematoma, Heparin, and Anticoagulation.

Cerebral Venous Dural Sinus Thrombosis

Cerebral venous dural sinus thrombosis is a rare form of a stroke that occurs in the brain. It typically affects women and children, with very few cases involving the male population (Agne Paner, Walter M. Jay, Sucha Nand & Laura C. Michaelis, 2009). Understanding this neurological disorder has been a challenge for the population for many years; however, with the rapid improvements of MRI (magnetic resonance imaging) and CT scanning (computerized tomography), the understanding of the disorder has evolved rapidly (A. Paner et al., 2009). In order to reverse the disease, a diagnosis needs to be made promptly. Diagnosis of cerebral venous dural sinus thrombosis usually takes up to seven days, which is far too long considering fatality is possible (Jennifer Lin & Hartmut Brückmann, 2010). Therefore, understanding the pathophysiology, risk factors, diagnostic testing, treatment, nursing care, and preventative measures that can be taken is significant to ensure patient safety.

**Review of Literature**

The first article is named, *Cerebral Vein and Dural Venous Sinus Thrombosis: Risk Factors, Prognosis and Treatment a Modern Approach* and is written by Agne Paner, Walter M. Jay, Sucha Nand, and Laura C. Michaelis. This article focuses in on the clinical presentation, prognosis’, outcomes, diagnostics, risk factors, treatment, supporting factors, and risk for reoccurrence. It also mentions specific clinical trials that were used to study dural sinus thrombosis. The actual pathophysiology is lacking in this article and could be more elaborated. Also, since the location of the thrombosis is so rare, I believe they should have included more thorough pictures explaining the pathophysiology. The second article utilized in this research was *Cerebral venous sinus thrombosis* Allroggen written by H. Allroggen and R.J. Abbott. This article had the same basic categories listed as the first article discussed, however, there is no treatment options, diagnostic tasting’s, pictures explaining the location, or education on reoccurrence or outcomes that may occur. The pathophysiology and etiology was very well laid out in these articles., *Acute treatment of cerebral venous and dural sinus thrombosis* written by Ferro and Canhão solely focused on the treatment options for dural venous sinus thrombosis. It was the article used primarily is discussing the treatment. *Cerebral venous thrombosis- an update* written by Chowdhury, Rahman, Khan, Habib, Miah, Ayaz, and Patwaryinusdid an excellent job and breaking down the symptoms and things to look for in a patient who may have DVT. The information in that article was very well written and there were minimal areas that were misunderstood by the reader. The next article was *Pathophysiology of cerebral venous thrombosis- an overview* by Itrat, Shoukat, and Kamal, was the article primarily used in this paper for the overview and pathophysiology of the disease. It gave the most information on the topic and was well organized and informative. Compared to the other articles, the pathophysiology written had more details and broke down the material to be better interpreted. *Cerebral venous and dural sinus thrombosis: State-of-the-art imaging* by Linn and Bruckmann, helped readers understand venous sinus thrombosis compared to the other clots that can be formed in the brain. It broke the information down and provided pictures explaining that location of the clot. This article was the most beneficial in telling the reader what exactly is happening within the brain. The last article used during research was *Cerebral Venous Thrombosis* by McElveen. This article was utilized to discuss the diagnostic procedures because it outweighed other articles in this area. Every article used in the research based their judgments off of treatments of an ischemic stroke. All of the research by the multiple authors reveals that diagnosis, clinical signs and symptoms, and medical management of a cerebral sinus venous thrombosis are almost identical to a typical ischemic stroke. Therefore, guidelines used in the clinical setting for treatment and diagnostics are those of a regular ischemic stroke. The only differences is the actual location of the thrombus. Finding research for this topic was somewhat difficult. There is no current and up to date information written specifically on cerebral venous dural thrombosis. So many different sinus and vessels lie within the brain, a lot of the research intertwines with each other making it difficult to set the data apart. If one had never experienced this type of patient, treatment options may be unknown. But when researching guidelines, the American Heart Association reveals that treating it like an ischemic stoke is most beneficial.

**Methods**

Research will be gathered from multiple sources to construct this paper for a systemic review of cerebral venous dural sinus thrombosis to gain understanding and improve patient care. Sources that will be utilized include online journals that have been retrieved from OneSearch. OneSearch is an online database that allows users to filter through several online journals to find data that is scholarly, peer reviewed, and most accurate pertaining to a specific research topic. Textbooks will also be utilized when writing this paper. Focus On Adult Health: Medical-Surgical Nursing and Nursing Now: Todays Issues, Tomorrow's Trends will be used to help ensure accurate information is being presented within this paper. Any information that is presented by global health organizations such as the World Health Organization will also be used because it contains the most recent research. Cerebral venous dural sinus thrombosis was not found in any recent journal articles so the paper will use articles from the past and present to allow proper understanding of the condition. The International Study on Cerebral Vein and Sinus Thrombosis (ISCVT) is a clinical trial that will be referred to throughout this paper. ISCVT is the best study to date on cerebral venous thrombosis and one of very few studies that provides data on the clinical presentation and history of the condition (Paner, Jay, Nand & Michaelis, 2009). By accessing multiple sources, the paper will allow readers to understand the cerebral venous dural sinus thrombosis and how a nurse should treat the patient if the situation were to occur.

**Overview of Cerebral Venous and Dural Sinus Thrombosis**

Cerebrovascular accidents are very common and often occur the population. The brain is composed of several veins and arteries. Thrombus frequently occur in the arteries and sometimes appear in the veins. When a clot appears in the veins it is much harder to diagnose due to presence of anastomoses between the cortical veins. These allow the blood to find other pathways through the brain to bypass the occlusion (Holger Allroggen, Richard J Abbott, 2000). During a cerebral venous dural sinus thrombosis there is a blockage in the cerebral veins and the dural sinuses which prevent blood from emptying into the internal jugular veins (Holger Allroggen, Richard J Abbott, 2000). According to Allroggen and Abbot, the superior sagittal sinus and the lateral sinuses are the two cerebral venous sinuses that are most affected (2000). More than one vein in the brain is typically affected at the same time. Since the venous drainage is compromised there is a disruption in the blood brain and blood cerebrospinal fluid barrier and it can lead to hemorrhage, hematomas, and venous infarction (A. Itrat, S. Shoukat, & A.K. Kamal, 2006). The process causes vasogenic and cytotoxic cerebral edema which is what actually causes petechial hemorrhage and eventually hematomas (Chowdhury, Rahman, Khan, Habib, Miah, Ayaz, Deb, Islam, & Patwary, 2011). The complete or partial occlusion of the sinuses lead to vascular congestion and generalized neurological deficits (A. Itrat, et al., 2006). A cerebral venous and dural sinus thrombosis would be categorized as an ischemic stroke. Ischemic Stoke can be defined as a disruption of blood flow in the brain secondary to an obstruction in a blood vessel (Pellico, 2013, pp. 1247). The common symptoms, treatment, and medical management can over lap between stroke types; however cerebral venous and dural sinus thrombosis may take longer to treat and diagnose than more common forms of stoke.

**Critical Analysis Cerebral Venous and Dural Sinus Thrombosis**

**Risk Factors**

There have been several predisposing risk factors for cerebral venous thrombosis. The condition can be caused by infectious causes, systemic conditions, or lifestyle choices. In the past, staphylococcus infection of the face and paranasal sinuses have been linked to causing cerebral venous thrombosis (A. Itrat, S. Shoukat, A.K. Kamal, 2006). Also, connective tissue disease, inflammatory disorders, and malignancies have had connections to the disorder (A.Itrat, S. Shoukat, A.K. Kamal, 2006). According to Holger Allroggen and Richard J Abbott, “hereditary prothrombotic conditions such as Factor V Leiden (leading to increased resistance to activated protein C), deficiency of proteins C and S and antithrombin III as well as prothrombin gene mutations may account for 10–15% of cases of CVST” (2000). José M. Ferro and Patrícia Canhão believe that the chance a venous thrombosis varies depending on different conditions an individual may experience such as surgery, pregnancy and the puerperium, intracranial, ear and sinus infections, cancer, inflammatory diseases, dehydration, obesity, or the use of oral contraceptives” (2003). If patients have the prothrombin gene mutation and use oral contraceptives they increase their chance significantly for developing a cerebral venous thrombosis (Paner, et al., 2009). It has also become evident that hormonal replacement therapy has a strong link with the development of dural sinus thrombosis (Paner, et al., 2009). In the ISCVT study, 4.3% of the patients were receiving hormonal therapy (Paner, et al., 2009). “A significant number of patients with CVST have underlying malignancy. In the ISCVT study 7.4% of patients (46 of 624) had cancer; 20 patients had solid tumor; 14 suffered from central nervous system and 18 from hematological malignancy” (Paner, et al., 2009). Another risk factor mentioned by Pellico, includes obesity and diet (2013, pp. 1250). If a patient is obese and eats excessive salt and high cholesterol foods it can lead to hypertension and hypercholesterolemia. Hypertension is going to affect the way the blood flows through the brain and hypercholesterolemia is going to cause plaque build up in the veins and arteries which will allow an occlusion to occur more easily (Pellico, 2013, pp. 1250). Many of these experiences apply to women which makes it apparent why it is seen more often in woman then men. If a patient presents with any of these conditions about and is experiencing stroke like symptoms, it would make an apparent need to check the patient for a cerebral venous thrombosis.

**Clinical Presentation**

Each patient’s symptoms with a stroke may vary slightly. The most common presenting factor of a stroke includes sudden numbness of the face, arms, or legs, typically on one side of the body (Pellico, 2013, pp. 1251). Patients also typically experience confusion, changes in mental status, trouble speaking, visual disturbances, dizziness, loss of balance, and severe headache (Pellico, 2013, pp. 1251). The headache typically worsens as the days go on but sometimes patients experience a sudden thunderclap headache (Chowdhury, et al., 2011). Depending on whether the stroke occurred on the left or right side of the brain different symptoms may be apparent. A stroke in the left hemisphere of the brain is accompanied by paralysis of the right side of the body, right visual field deficit, aphasia, altered intellectual ability, and slow or cautious behavior (Pellico, 2013, pp. 1251). If the stroke occurred in the right hemisphere the patient may experience paralysis or weakness on the left side of the body, left visual field deficit, increased distractibility, impulsive behavior, poor judgment, and lack of awareness (Pellico, 2013, pp. 1251). The abnormal vision is seen in almost every case. The rise in intracranial pressure causes swelling of the optic disc which is responsible for the visual obscurations (Chowdhury, et al., 2011). Seizures are also very common when the patient has a cerebral venous thrombosis. The seizure typically affects one part of the body and is unilateral (Chowdhury, et al., 2011). Some less common clinical manifestations include coma, tinnitus, cranial nerve palsies, vomiting and papilledema (Ferro & Canhao, 2003). Knowing the appropriate signs and symptoms will help the provider narrow down where the thrombus is the brain is located. It will also allow for quicker diagnosis which may help stop the clot form growing and prevent further complications.

**Diagnostic Procedures**

The diagnosis of cerebral venous thrombosis takes multiple test and time to accurately diagnose the disease. According to Holger Allroggen and Richard J Abbott, “Magnetic resonance imaging (MRI) combined with magnetic resonance venography (MRV) have largely replaced invasive cerebral angiography and conventional computed tomography (CT)” (2000). An invasive angiograph could cause the clot to break off and travel to the heart resulting in death. Once the mass is found on the MRI, other laboratory test need to be completed for identification because it could be mistaken for a brain tumor instead of a clot. The American Heart Association and American Stoke Association have provided guidelines to diagnose a cerebral venous thrombosis. Routine labs such as a complete blood count, prothrombin time, chemistry panel, and activated partial thromboplastin time should be evaluated (W.A, McElveen, A.P, Keegan, 2015). The patient should also be screened for prothrombotic conditions during the assessment because it can benefit the treatment process (W.A, McElveen, A.P, Keegan, 2015). Coagulation studies should also be performed if the patient or family has a past of reoccurring thrombosis. According to Allrogen and Abbot, “a search for the Factor V Leiden mutation if resistance to activated protein C is abnormal, activities of proteins C and S and antithrombin III, plasminogen, fibrinogen and anticardiolipin antibodies” should be evaluated because it can be the key to diagnosing the patients condition. (2000).

**Treatment**

The treatment of cerebral venous thrombosis always begins with anticoagulation. Anticoagulation prevents propagation and new clot formation, while eliminating the occlusion (Paner, et al., 2009). Patients are usually started on a heparin or low molecular heparin drip, which is then followed by warfarin therapy (Chowdhury, et al., 2011). The patient would be discharged from the hospital on warfarin to avoid reoccurrence of the thrombosis. The patient would be required to take the warfarin for different amounts of time depending on why the thrombosis developed. If the thrombosis developed due to a temporary circumstance like pregnancy the patient would take warfarin for 3 months; however, if the condition was unprovoked an occurred due to other causes such as hyperlipidemia and obesity the patient would require treatment anywhere from 6 to 12 months (Chowdhury, et al., 2011). Two randomized trials have been conducted to determine if anticoagulation with heparin or low molecular weight heparin in cerebral venous sinus thrombosis is a successful in removing the occlusion in the brain (Paner, et al., 2009). Many people died to hemorrhage during both trials; however, the meta analysis reveals that a trend in favor of anticoagulation therapy was determined and it was deemed safe to use the anticoagulation for cerebral venous sinus thrombosis, even if there is apparent intracranial hemorrhage (Paner, et al., 2009).

If anticoagulation therapy is unsuccessful, thrombolysis may be recommended. Thrombolysis is the deletion of the thrombosis with medication and is sometimes call clot busting. The difference in anticoagulation and thrombolysis is that during thrombolysis, the medication is injected into the clot or a vein that travels directly to the blockage (Chowdhury, et al., 2011). There are many dangers to these therapies and a thorough family and past medical history should be evaluated before beginning the use of these medications (Chowdhury, et al., 2011). Anticoagulation therapy and thrombolysis can cause intracranial hemorrhage to severely worsen and can cause the patient to bleed out leading to death (Paner, et al., 2009). However, at the time, the clinical trials that have been performed prove the therapies to be more beneficial than detrimental.

Due to the neurological deficit and increased intracranial pressure caused by the stroke, the patient is very prone to having seizures. ISCVT studies have implied that using antiepileptic drugs for the patients who are at risk for having a seizure would be beneficial (Paner, et al., 2009). Having the patient on the medication when there is evidence tat seizure activity can occur can prevent the patient from further cognitive dysfunction. Corticosteroids have also been used during treatment of cerebral venous sinus thrombosis because they potentially decrease vasogenic edema; however, there is a risk of further complicating the condition. The most common treatment measures are the heparin and warfarin coagulation therapy and its is what one may see being used in the hospital setting.

**Prevention**

In cerebral venous sinus thrombosis there is a chance that the clot will reoccur. Studies actually concluded that there is a 2.8% chance that patient may experience recurrence (Paner, et al., 2009). These recurrences actually occur very often while the patient is still in the beginning anticoagulation therapy. In order to try and prevent clot reformation, the patient is a timed therapy or lifelong anticoagulation therapy (Paner, et al., 2009). Anticoagulants make it to where the clot can not physically grow any larger. The American Heart Association states “a target international normalized ratio of 2.0 to 3.0 for three to six months in patients with provoked cerebral venous thrombosis and 6 to 12 months in those with unprovoked cerebral venous thrombosis” indicating these are the preventive goals. If the patients levels stays in the listed ranges, they are less often to experience another clot. The patient may be on the lifelong therapy rather than then timed therapy if they have conditions that predispose them such as thrombophilia (American Heart Association & the American Stroke Association, 2011). Dietary changes and exercise should be included to help keep plaque from forming in the vessels. The increased of plaque in the vessels can actually allow clot formation to occur. There is nothing that can directly prevent and cerebral venous dural sinus thrombosis, however lifestyle modifications and anticoagulation therapy can lower the chances of clot reformation.

**Nursing Diagnosis**

A patient with dural sinus thrombosis can have several nursing diagnoses. The diagnoses below were carefully formulated for the actual patient who stimulated this extensive research.

* Ineffective tissue perfusion related to interruption of blood flow as manifested by changes in motor skills, sensory responses, language, and emotional status (Wittman-Price, Thompson, Sutton, & Eskew, p.418-419, 2013).
* Impaired physical mobility related to neuromuscular involvement as manifested by weakness and inability to use the right extremities of the body (Wittman-Price, Thompson, Sutton, & Eskew, p.418-419, 2013).
* Impaired verbal communication related to impaired cerebral circulation as manifested by impaired articulation and inability to comprehend spoken language (Wittman-Price, Thompson, Sutton, & Eskew, p.418-419, 2013).
* Risk for falls related to right side weakness (Wittman-Price, Thompson, Sutton, & Eskew, p. 462, 2013).
* Risk for bleeding related to anticoagulation therapy (Wittman-Price, Thompson, Sutton, & Eskew, p. 461, 2013).
* Ineffective coping r/t situational crisis as evidenced by patient refusing assistance
* Acute Confusion related to decreased level of conscious (Wittman-Price, Thompson, Sutton, & Eskew, p.446, 2013).
* Risk for impaired skin integrity related to inability to turn self in the bed (Wittman-Price, Thompson, Sutton, & Eskew, p. 463, 2013).

**Nursing Considerations**

The role of a nurse for a patient with venous sinus thrombosis is very critical concerning the patient’s outcome. “During and after the acute phase, nursing interventions include a comprehensive approach to physical care and fostering recovery by listening to the patient and asking questions to elicit the meaning of the strike experience” (Pellico, 2013, pp. 1261). A stroke impacts multiple body systems leaving a nurses work more extensive than some other conditions. The nurse is required to help the patient improve their mobility in order to prevent joint deformities during the post stroke status (Pellico, 2013, pp. 1261). Pellico (2013) states, the elbows, knees, shoulders, hands, fingers, and waist are all problem areas that need to be worked in these patients to avoid contractures (p. 1261).

The next nursing consideration is helping the patient improve their ability to perform self care task such as brushing the hair and teeth, shaving, and eating. (Pellico, 2013, pp. 1263). According to Pellico (2013), the patient must begin these activities on the unaffected side, while slowly transforming to the affected side (p. 1263). The nurse is responsible for make sure the patient does not forget to use the affected limb out of fear of use. The nurse has to not only be there for physical but emotional support and encouragement (Pellico, 2013, pp. 1263).

The third nursing interventions stated by Pellico (2013), is that the nurse is responsible for helping the patient the patient avoid difficulties caused by sensory and perceptual deficits (p. 1263). When a patient has a visual or hearing impediment, it is important for the nurse to be conscious and approach the patient from and angle where they can hear or see the nurse. It will help ensure the nurse to patient relationship is more trusting. Pellico (2013) reveals that’s the nurse is also responsible for educating the patients of ways to adjust the head or body to avoid the visual field deficits (p. 1263). When large amount of visual field is lost it is important for the nurse to remind the patient of their affected side of the body because it can cause the extremities to become unaligned (Pellico, 2013, p. 1263). This nursing intervention helps the relieves stress and anxiety for the patient because they wont be caught off guard during their treatment.

After a stoke, aphasia is a very common symptom. It is the nurses job to help the patient regain their communication skills. Pellico (2013), says the nurse should provide the patient with written materials that help them verbalize their thoughts without their voices (p. 1265). Some other materials that may be beneficial include a communication board, check list, audio taped list, pictures, and flash cards (Pellico, 2013, p. 1265). Pellico (2013) also reminds nurses to always talk to the patients even if they do not talk back. Providing care without warning can be fearful to the patient even if there are not intentions of harm (p. 1265).

The last nursing intervention being discussed is maintaining the patients skin integrity. According to Pellico (2013), “the patients skin may beat risk for skin and tissue breakdown because of altered sensation and inability to respond to pressure and discomfort by turning and moving” (p.1265). In some hospitals, special beds are used to help keep the patient from retrieving bed sores. When this luxury isn’t available, the patient is turned in bed every two hours. Maintaining skin integrity is important because a wound can be not only painful but dangerous. Pressure ulcers can become severely infected and cause more problems then originally noted. The patients skin needs to stay dry and clean at all times to ensure that tissue integrity is not compromised (Pellico, 2013, p. 1261).

**Orem’s Self Care Model**

According to Joseph T. Catalano (2012), Dorothea. E Orem’s nursing theory was coordinated on the idea that patients must provide self-care if they want to reach an optimal level of health. Nothing that a nurse or provider does for a patient is going to put them in a healthy state if they refuse to help themselves first. Orem’s self care model can be used during certain causes of cerebral venous thrombosis. Obesity, hypertension, and hypercholesterolemia are all modifiable risk factors of a stroke (Pellico, 2013, p. 1250). The Orem self- care model is aimed toward helping patients carry out activities that improve their current health status (Catalano, 2012). Encouraging a patient to implement a healthy lifestyle and diet can help lower the risk of a stroke. It would be a task that the patient would have to commit to and a goal they would solely achieve on their own which makes it part of the Orem’s Self-Care model. Other risk factors of the cerebral venous thrombosis would not fall under this model. The patient cannot change what was passed down to them hereditarily or any gene mutations they were born with.

**Conclusion**

A cerebral venous sinus thrombosis is a stroke, categorized as ischemic, that may occur in three to four out of every one million stroke cases each year. It affects women much more often then men and is very difficult to diagnose. The diagnosis is typically delayed but through thorough investigation of clinical signs, symptoms, laboratory findings, and imaging studies the diagnosis is achievable. Cerebral venous sinus thrombosis has a wide spectrum of clinical manifestations and requires specific test for actual diagnosis. The symptoms that are usually associated with the thrombosis include headaches, fatigue, one sided weakness, aphasia, decreased level of consciousness, and loss of balance. A Magnetic resonance imaging (MRI), magnetic resonance venography (MRV), and a catheter angiography are the procedures that can be performed to properly diagnose the thrombosis. The treatment primarily focuses on three things which include treating the underlying condition, anticoagulant therapy, and reducing intracranial pressure. The rate reoccurrence of cerebral venous sinus thrombosis is extremely high therefore preventative measures should be taken. The patient should be on a set dose of Coumadin for 3 to 6 months until INR is within the preferred range. The patient should also change her diet eliminating salty foods that affects blood pressure or other distinguished risk factors. Many nursing diagnoses can fit a patient who has experienced this disorder. The nurse needs to be considerate of the patient’s ability to talk, perform self care, and move joints in the body. The nurse also needs to provide preventive measure to avoid any skin or tissue break down to the patient. Proper care by the nurse allows the rehabilitation of the patient, after a stroke, to go more smoothly and achieve goals quicker. The Orem’s Self Care model is the nursing theory that fits the patient’s status. Post stroke the patient is trying to regain mobility and become independent which is what the Orem’s Self Care model represents. The articles reviewed in the literature review are the most current articles obtained discussing cerebral venous sinus thrombosis. Most research reveals that treatment is provided as if the patient had a normal ischemic stroke. The only difference is that a cerebral venous sinus thrombosis occurs in the vein rather than an artery and requires more extensive testing and time to discover. The thrombosis needs to be detected as soon as stroke like symptoms appear because the location of the clot could end the patient’s life abruptly.

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