

Risks Associated with Treating S.M.A.R.T Syndrome Using Blood Thinners for Pediatric Patients Who Received Cranial/Spinal Irradiation - A Case Report

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ABSTRACT

S.M.A.R.T Syndrome (Stroke-like Migraine Attacks after Radiation Therapy) is a late complication after cranial radiation, along with seizures, and white matter lesions. SMART syndrome is diagnosed in patients who previously received craniospinal irradiation presenting with unexplained headaches, seizures and hemiparesis (weakness on one side of the body which is reversible) few years after irradiation. M.R.I (Magnetic resonance imaging) is usually helpful in diagnosis. In such cases, blood thinners such as Aspirin are prescribed as a medication to decrease the potential risks associated with radiation induced brain infarction/necrosis to avoid further deterioration. However blood thinners such as Aspirin have been linked to sudden hematoma occurring in the brain. The case reported was observed in a patient with vasculopathy/S.M.A.R.T syndrome who previously underwent high dose chemotherapy, and craniospinal irradiation (CSI) and was prescribed baby aspirin which may have contributed to epidural hematoma/hemorrhage.

Introduction

The pathophysiology (study of how a disease or condition can change a patient physical, and functional conditions) of SMART syndrome is not completely understood, however it is believed to be multifactorial. Vascular dysregulation (is a medical condition in which blood flow is not evenly distributed to serve the needs of various tissues), and cerebral endothelial dysfunction (constriction of large blood vessels in brain) will play a role in the pathogenesis (origin/development of disease). Medications such as Aspirin can have beneficial effect in reducing the constriction of blood vessels in the brain, and has been used in SMART syndrome patients to prevent progression of the syndrome.

The case, explored today, refers to a pediatric patient with underlying brain damage, with Epidural Hematoma, which is excessive bleeding in the epidural (top) layer of the brain. The blood thinner, Aspirin, was given to the patient a few months prior to help with the recovery of his S.M.A.R.T syndrome. This article explores the potential detriments of using blood thinners for patients who underwent craniospinal irradiation and who are at risk for stroke. Blood thinners can cause bleeding from a blood vessel and cause formation of clots (intracranial hematoma) in the brain. This usually occurs from blood vessels rupturing in the skull. The excessive bleeding causes intracranial pressure which compresses dura mater and brain parts. Different parts of the brain control different human abilities, so compression can cause damage to those parts resulting in long term neurological issues.

Case Study

A 5-year-old boy was admitted to a hospital for right side weakness after a mild fall. The patient had undergone surgery for resection of medulloblastoma (brain tumor), high dose chemotherapy, autologous peripheral blood stem cell transplant, and proton beam radiation dosage of 3600 cGy/additional 1000 cGy boost on focal posterior fossa respectively for treating this metastatic (spreading of cancer cells to brain & spine) disease two years prior. The patient also had a non-programmable VP shunt to drain C.S.F (cerebrospinal fluid) after the resection. The patient was evaluated and diagnosed with reversible Stroke Like Migraine After Radiation Therapy Syndrome (S.M.A.R.T syndrome).

The patient was treated with Nimodipine/calcium channel blockers (for vascular dysregulation) and to increase the blood flow of the injured brain tissue and other seizure medications. During an MRA (Magnetic Resonance Angiogram) an abnormal imaging pattern sharing the same characteristics of seizure and stroke was identified and treated with 81 mg of baby Aspirin for approximately two and a half months. The patient was discharged a few weeks after. The patients was on the following medications after discharge:

- Clobazam 2ml at night (for seizures)
- Keppra 300 mg (for seizures)
- B6 25mg at night (to treat irritation with keppra)
- Levothyroxine 50mg (For hypothyroidism)
- Aspirin 81mg (Blood thinner)
- Nutropin 0.5mg (To treat growth hormone deficiency)

Suddenly, a little less than 2 months later, the patient complained of severe, and aggravating headaches and was admitted into emergency with nausea. The patient was diagnosed with epidural hematoma for 2 spontaneous bleeds and underwent two surgeries for his left and right sides of the brain and treated surgically for evacuation of the blood.

Based upon surgical notes the surgeons initially thought the bleeding was a result of subdural hematoma, meaning that bleeding occurs in the subdural area of the brain. However, it was evident during the operation that a large epidural hematoma was present in the right occipital side of the epidural brain. The condition appeared to be very coagulopathic. This means that the blood's ability to clot is weakened and impaired. This allows more blood to bleed in the epidural area of the brain. During the procedure, the patient received platelets, fresh frozen plasma, and more red blood cells. The surgeons were able to evacuate the hematoma. After evacuation, the patient's bone flap was changed with micro plates & titanium screws. Along with that drains were placed for further evacuation of the blood. After the patient was placed back into the ICU, an emergency CT scan showed that the bleeding had appeared in the left parietal part of the epidural brain. Another surgery was done to evacuate the blood and followed a similar procedure as the first one. After the surgery, another CT scan was done and the epidural hematoma appeared to calm and in a stable position. Between the surgeries the patient lost about 500 mL of blood. The surgeons also suspected that the hematoma had originated from over shunted hydrocephalus and Aspirin. Along with that, his pre-existing brain conditions were attributed. The patient was monitored for a few months with MRI, and MRA to ensure that the evacuation was successful. Additionally, rehab, PT, and OT were provided for the long road of recovery.

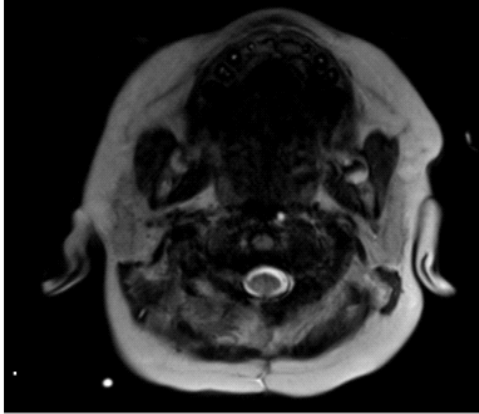


Figure 1. (T2 weighted image taken 11 days after surgical evacuation with epidural drains). The Hematoma is in the perimeter of the skull (shown in white). The right frontal epidural collection and the left frontal epidural collection measuring 18

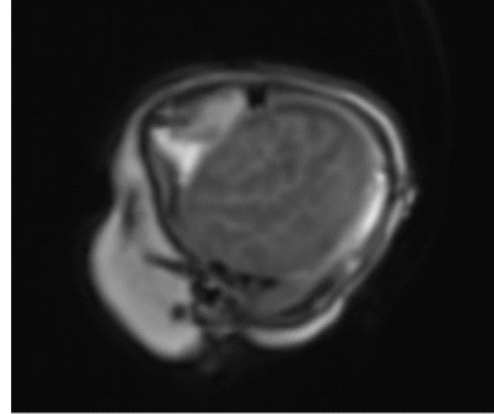


Figure 2. (T1 weighted image 13 days after surgical evacuation and after epidural drain removal). Hematoma can be seen enlarged on the left side of the epidural (shown in white).

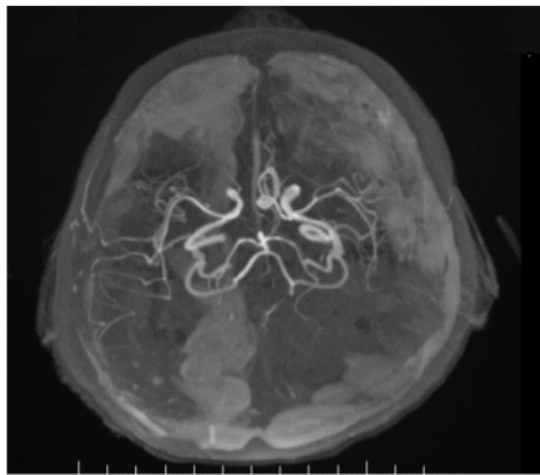


Figure 3. (Time-of-flight MRA of the intracranial vessels). MRA was performed 13 days after surgical evacuation and epidural drain removal to visualize blood flow and vessels. After removal of epidural drains, blood flow seems normal

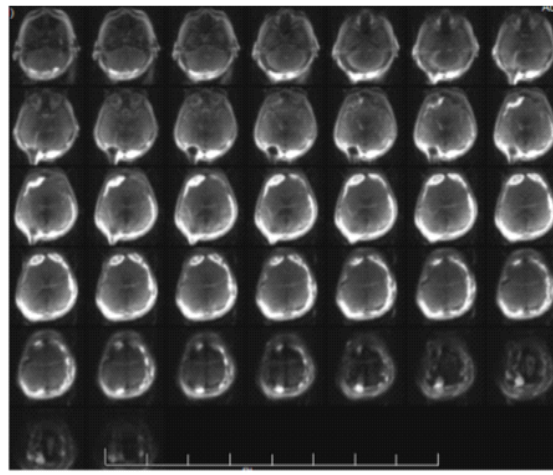


Figure 4. (Conventional MRI, 13 days since surgical evacuation). Hematoma appears left and right sides across the perimeter of the skull (shown in white).

Discussion/Conclusion

S.M.A.R.T syndrome is a severe condition with limited pediatric data regarding the number of cases per year. As a result, diagnosing and treating S.M.A.R.T on time is filled with complications. For this reason, treating with blood thinners can pose the risk of hematoma. Consequently, a careful medical evaluation is required.

Although in many cases surgical intervention may not be needed to treat blood thinners induced hemorrhage, some cases may require immediate emergency procedures to evacuate the blood from the affected area. Hematoma causes the brain to be compressed with intracranial pressure, affecting many more areas of the brain and leading to neurological impairments and hormonal imbalances. Appropriate follows up with an endocrinologist to conduct various hormonal tests to determine specific hormonal deficiencies and to treat them accordingly. Hematoma can cause imbalance and difficulty walking, speech & auditory processing problems, and hearing impairment, fine motor skills, and gross motor skills. Appropriate rehabilitation and therapies like PT, OT, and Speech therapy need to be provided to improve the conditions for recovery. Overall, Epidural Hematoma can prompt many lifestyle changes and can impact the quality of somebody's life. For this reason it is necessary to realize when certain cranial problems call for blood thinners, and to weigh the risks of hematoma occurring.

Alternative approaches need to be evaluated for treating S.M.A.R.T, and Vasculopathy patients. Families and Patients need to consult with their neurologist(s) to figure out if blood thinners are right for their specific condition. It is important to remember that different medications are used for different purposes, and every patient's condition is unique. More research is needed in this area to identify and develop the most appropriate treatment plans to decrease adverse effects of treatment.

Statement of Ethics

The patient's parents have provided consent for the use of medical records/images, and the publication of this case study.

Acknowledgments

I would like to thank my advisor for the valuable insight provided to me on this topic.

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