

## Management of Thrombosis in a Neuro-Oncology Patient

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Mr. B is a 27-year-old man with no significant medical history. He presented two weeks ago with new onset of generalized seizures during his sleep that awoke his wife, who stated, "He was shaking the bed." She was unable to get him to respond. The tremors lasted approximately five minutes. Mr. B was taken to a local emergency room, where a head computed tomography (CT) scan was performed, revealing a 2 cm abnormality in the right temporal lobe, with no evidence of hemorrhage. The patient was given a loading dose of phenytoin and started on IV dexamethasone 10 mg every six hours. Mr. B was transferred to a large medical center for further workup and evaluation.

After admission to the medical center, the patient underwent a staging workup, including magnetic resonance imaging (MRI) of the brain with and without contrast and a CT scan of the chest, abdomen, and pelvis to rule out a primary source of the brain lesion. No primary source was detected. A brain biopsy was performed that revealed a high-grade astrocytoma, World Health Organization grade III (Kleihues, Burger, & Scheithauer, 1993). Mr. B had a craniotomy with postoperative MRI confirming gross total resection. He was scheduled to receive six weeks of radiation therapy and oral temozolomide at 75 mg/m<sup>2</sup> daily for six weeks. He had completed 40 Gy out of 60 Gy of radiation therapy and was continuing on oral temozolomide when he called the triage nurse educator with complaints of right lower-extremity pain, redness, and swelling. An ultrasound of the right lower extremity confirmed a diagnosis of occlusive deep vein thrombosis (DVT). He was hemodynamically

stable and otherwise had no complaints. He was started on low-molecular-weight heparin, 1 mg/kg subcutaneously every 12 hours. The clinical nurse specialist instructed Mr. B on self-injection, side effects of enoxaparin, and follow-up care. His insurance company approved enoxaparin prior to instituting the regimen. He was instructed to report any signs of bleeding and have his platelets checked twice weekly while he continued radiation and temozolomide. If the platelet count was less than 50,000/ml, enoxaparin would be held.

### What is the incidence of thrombus and what are the implications of the diagnosis in the neuro-oncology population?

A thrombus is a clot that forms as a result of vascular wall injury, venous stasis, and hypercoagulability. The symptom cluster has been described as Virchow's triad (Cervantes & Rojas, 2005). Malignancy produces a hypercoagulable state. Individuals with cancer have an increased incidence of thrombus, up to seven times more than those with no malignancy (Blom, Doggen, Osanto, & Rosendaal, 2005). In the hypercoagulable population, patients with brain tumors have a particularly high incidence of venous thromboembolism (VTE) (Gerber, Grossman, & Streiff, 2006). Patients with large glial tumors have increased tissue factor production and increased levels of active coagulation factors (Sciacca et al., 2004) (see Table 1).

If a patient develops symptoms of DVT and is not treated, the risk is almost 50% that the patient will develop a pulmonary embolus, resulting in significant morbidity and mortality; therefore, assessment and timely

intervention and treatment of DVT are vital in all patients (Gerber et al., 2006). In the past, anticoagulants have been administered somewhat reluctantly to patients with primary brain tumors because of a fear of intracranial hemorrhage. Growing evidence suggests that anticoagulation may be more effective than inferior vena cava filtration devices for treating VTE in patients with brain tumors and that the risk of hemorrhage with anticoagulation is relatively small (Wen & Marks, 2002).

### What are the risk factors for development of deep vein thrombosis?

Kyrle and Eichinger (2005) stratified the risk of DVT as follows.

- **Low risk:** minor surgery in patients younger than age 40 with no additional risk factors
- **Moderate risk:** minor surgery and additional risk factors; surgery in patients aged 40–60 with no additional risk factors
- **High risk:** surgery in patients older than age 60 or aged 40–60 with additional risk factors (e.g., previous VTE, cancer, thrombophilia)
- **Highest risk:** surgery in patients with multiple risk factors (e.g., older than age 40, cancer, previous VTE, hip or knee arthroplasty, hip fracture surgery, major trauma, spinal cord surgery)

In patients with a first spontaneous DVT, the annual likelihood of recurrence is 5%–15%, with a cumulative recurrence rate of about 25% after four years. Risk of recurrent DVT is low in patients who develop it postoperatively (Kyrle & Eichinger, 2005).

### What other factors increase the risk of deep vein thrombosis or venous thromboembolism?

Each year, about 19,000 people in the United States are diagnosed with primary brain cancers. The risk of developing brain

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