**Case Study on Patient**

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Proton Therapy, Photon Therapy, Chemotherapy, Radiotherapy,

Brain cancer occurs when malignant cancer cells form a mass of cancer tissue within the brain tissue (petr, 2018). This mass that is formed interferes with basic bodily functions such as muscle movement and memory (Neuhaus, 2019). Cancerous cells that originate in the brain are known as primary brain tumors. Brain cancer can occur due to hereditary genetic conditions or form as a secondary brain tumor where the cancer originated from a different part of the body and metastasized. Gliomas are the most common form of brain cancer; however, they have various subtypes including astrocytoma’s, oligodendrogliomas, and ependymomas. Brain cancer has four different stages, progressing with increase of number (Rajaratnam, 2020). Stage one being a benign tumor, and stage four being malignant tumors that appear abnormal and grow at a quick rate (Petr, 2018). Brain Cancer seldomly spreads to other organs and is staged based off the cell type and grade of the tumor (Neuhaus, 2019).

**Introduction**

**Patient Initials: JG**

**Initial Date of Patient Consult/Treatment: May 1, 2020**

**Patient Age: 62**

**Gender: Male**

**Occupation: Rig driller**

**Recent Progress**

**Subjective Patient Complaints:** Secondary Brain cancer- difficulty speaking, unable to walk, difficulty controlling limbs, and tunnel vision.

**Onset:** a month before, the patient had a stroke and was diagnosed with stage four lung cancer

**What provokes these symptoms?** Stroke- by an irregular heartbeat, ischemic attacks, Lung cancer- provoked by smoking 1-2 packs of cigarettes a day for up to 25 years, Brain cancer- provoked by lung cancer that has metastasized.

**Quality of symptoms:** loss of balance, inability to form words, daily absent seizures, inability to control limbs and bladder- symptoms rated 10/10 due to apparent disturbance of everyday life.

**Is there any radiation of symptoms?** The inability to control the bladder, speak, and walk, difficulty seeing or expressing emotion.

**Describe the site of symptomatology:** cranial cavity/brain, lungs.

**Time of day/ duration of symptoms:** Daily episodes of dizziness, difficulty speaking, and trouble walking.

**Prior contributory health history:**

 1) Stroke prior to diagnosis 2) Occasional shortness of breath when walking/talking/ daily tasks 3) often episodes of feeling to have tunnel vision 4) Reports a history of being healthy, aside from his recent stroke and cancer diagnosis; and highly active with grandchildren, extremely involved with work. He enjoys caring for his eight grandchildren but finds it challenging to perform strenuous activities due to shortness of breath and occasional dizzy episodes.

**symptom Characteristics based on the Five Element Theory:**

a) Emotion of grief associated with his recent lung cancer diagnosis b) Patient's stress often causes shortness of breath and inability to get out of bed C) His pale skin indicates an ill-feeling associated with stress.

**Result Findings:**

A. Patient presents with a series of masses within lungs and brain.

 - computed tomography scans of lungs and brain.

 - Functional magnetic resonance imaging

 - biopsy of masses in lungs

 - angiograms

In summary, the medical diagnosis of secondary stage 1 brain cancer was given.

B. Intermittent absence seizures observed- Symptoms temporarily lessened with anti-seizure medications.

C. limb Characteristics: Mild inflammation of fingers and toes possibly due to numbness of arms and legs

D. Patient has a strong, appearance although his skin appears to be pale.

E. Patient was screened for any signs of further spread of cancer to other parts of the body aside from lungs and brain.

**Working Diagnosis:**

Stage IV lung cancer, Secondary stage I brain cancer

**Possible Treatment options:**

**Treatment #1:**

The first new treatment option for secondary cancer types is Proton Beam radiation. In brain cancer, Proton Beam Radiation is used to send therapeutic antibodies across the Blood-Brain Barrier. To safely ferry these antibodies across the blood-brain barrier, they must bind to fusion proteins or bispecific antibodies that consist of scFv or Fab effector moieties. One Fusion Protein that has shown promising results is an scFv Aβ-specific antibody fragment fused to an HIR-specific monoclonal antibody or to a cTfRmAb (petr, 2018). The anti- Aβ bound to the Aβ-amyloid plaque, causing the amyloid plaque to detach from the brain (petr, 2018). This study was observed in mice with Alzheimer's disease due to their excess in Aβ-amyloid plaques. Aβ-amyloid plaques are where glioma stem cells gather and adhere to each other, forming attachment bonds. This means that the anti-Aβ breaks the bonds of the stem cells to the Aβ-amyloid plaques, causing the tumor to detach and move on to apoptosis (petr, 2018).

**Treatment #2:**

The second Treatment option is photon radiotherapy, like proton radiotherapy. Instead of only causing damage to the tumor cells, photon therapy releases energy through the entire path it takes, damaging anything in its path. Proton therapy is much safer than photon therapy but has not been tested enough to prove it will work in patients with reduced amyloid plaques. The main issue with photon radiation is that it requires large doses to attack the tumor cells properly. While photon radiation requires large doses, it attacks deeply rooted tumors. The results of this study are quite conflicting, considering the benefits and the drawbacks contradict each other. While Photon therapy is fantastic for treating deeply rooted tumors, they leave neutron contamination within the body. Along with the massive volume required for treatment and the chance of neutron contamination, the benefit and the drawbacks cancel out, leading to a conflicting decision to make.

**Treatment #3:**

The third treatment option is the use of radiolabeled drugs. These drugs have been shown to either induce shrinkage/stabilization of existing metastasis or prevent metastasis. Mice injected lapatinib five days after being inoculated with the tumor showed a 54% reduction of large metastases within the brain. The study shows the best results when the drugs are administered within three days after tumor inoculation. It both reduced smaller metastasis and larger metastasis within days after the drug is administered. Using a combination of monoclonal antibodies against HER2 and VEGF resulted in a reduced density of the metastasis and increased cell death, thus improving the survival rate of the mice inoculated with said tumor cells.

**Treatment #4:**

The fourth treatment option is alternating electric field therapy. This type of cancer treatment is administered to patients via a portable battery-operated machine. This type of cancer therapy affects the tumor cell division process. The transducer arrays disrupt the formation of the mitotic spindle during metaphase and eventually lead to dielectrophoretic movement of the charged polar molecules during anaphase and telophase (petr, 2018). This movement disrupts the cell's normal cytokinesis, eventually leading to apoptosis of the cell (petr, 2018).

**Treatment #5:**

The fifth possible treatment option is one of the most used cancer treatment options; surgery. The surgical route is often used to remove large tumors. The only time a cancer tumor is removed from the brain is not to invade crucial parts of the brain (Neuhaus, 2019). Often surgery is more of a last-resort treatment option since it is extremely invasive (Neuhaus, 2019). It is unknown if the patient's body can sustain a lengthy surgery along with anesthesia. If the surgery is unsuccessful, the tumor was either invading crucial parts of the brain. The patient could not sustain the prolonged surgery, or there was a complication within the surgery.

**Treatment #6:**

The sixth treatment is also a commonly used tactic to combat cancer, known as chemotherapy. Chemotherapy is used to stop or slow the growth of fast-growing cancers (Rajaratnam, 2020). Chemotherapy can be used either before or after surgery (Rajaratnam, 2020). If this tactic is used before surgery, it is to shrink existing cancer cells for easier removal (Rajaratnam, 2020). This is known as neoadjuvant chemotherapy (Rajaratnam, 2020). If chemotherapy is used after surgery, it is to destroy and stop the growth of cancer cells that were missed in the previous surgery (Rajaratnam, 2020). This type of approach is known as adjuvant chemotherapy (Rajaratnam, 2020).

**Discussion**-**The patient's treatment agenda was as followed:**

Surgery was performed to remove a mass located on the lungs, followed by aggressive adjuvant chemotherapy in an attempt to shrink and kill existing cancerous tumors located in the lungs. After some time, the chemotherapy was not working, so radiation therapy was used in combination with chemotherapy in the patient's next visit. The patient felt as though the treatments were doing more harm than good, so he decided not to attend his next visit. It was not until the patient's condition became so crippling that his wife decided to take him to the Doctor. He had officially lost his ability to speak. This led the Doctor to believe his lung cancer had metastasized into his brain. After various scans of the patient's brain, the doctors concluded that the patient had secondary stage one brain cancer. The patient began neoadjuvant chemotherapy again, followed by surgery on his brain to remove the small mass affecting his speech. The Doctors could not remove the mass, as it was too difficult to remove without ruining the patient's basic bodily functions. The patient continued chemotherapy coupled with radiation therapy to shrink existing tumors and halt the spread of existing cancer. Within the next few months of treatment, the doctors concluded that the cancer was not getting better, only worse. With this conclusion, the patient was placed into the hospice program to no longer be traveling for treatment. His seizures were treated with anti-seizure medication, and he was placed on oxygen. Weeks after being placed into the hospice program, the patient passed peacefully in his sleep.

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