Tumor-Treating Fields

Nursing implications for an emerging technology

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Glioblastoma multiforme (GBM) is one of the most common types of glioma or primary brain tumor, with about 2–3 new cases arising per 100,000 adults per year (American Association of Neurological Surgeons, 2015). Although the incidence of primary brain tumors has increased during the past few decades, some experts speculate this trend may be attributed to multiple factors, including improved detection and imaging methods (Mason & Abrey, 2011). Unfortunately, advances in seeking a cure for glioblastoma have not paralleled the advances in imaging and detection. Prior to the introduction of tumor-treating fields (TTFields), the standard therapy for treatment of GBM was surgical resection, followed by radiation therapy and temozolomide (Temodar®), a chemotherapy agent that can be given orally or via IV infusion. Given the aggressive nature of GBM tumor cells, patients on standard therapy have a median overall survival of 14–16 months (Neagu & Reardon, 2015). Therefore, a need exists for improved treatments. Studies have shown that TTFields, in conjunction with temozolomide, improve progression-free survival and overall survival (Stupp et al., 2015).

TTFields use alternating electromagnetic fields to disrupt cell division through physical interactions with key molecules during mitosis, leading to cell death (Zhang & Knisely, 2016). The device is manufactured by Novocure, Inc., under the brand name Optune® and was approved by the U.S. Food and Drug Administration in 2011 for treatment of recurrent GBM as a monotherapy. In October 2015, it was approved for newly diagnosed GBM as an adjunct therapy (U.S. Food and Drug Administration, 2015). Patients treated by the device must be aged 22 years or older and have either newly diagnosed supratentorial GBM or recurrent GBM despite previous treatment with standard therapy (Novocure, Inc., 2016b).

Patient Education: Directions for Use

The TTFields system, considered durable medical equipment, consists of an electric field generator, a connection cable and box, four transducer arrays, four batteries and a charger, a power supply, and a carrying bag. One-time use, disposable transducer arrays are applied directly to the shaved scalp and connected to a portable battery pack that is carried by the patient in a shoulder bag. The second-generation Optune system is small and light, weighing 2.7 lbs. Four batteries are provided with the kit, and each lasts for two to three hours, with an overall battery life of six to nine months (Novocure, Inc., 2016b).

Some barriers to compliance with TTFields include reluctance of the patient to shave their head regularly, as well as reluctance to wear the electrodes and carry the battery pack for many hours each day. Because patients may be concerned about the stigma surrounding cancer, it is important for nurses to address concerns of physical appearance and adherence to the regimen as directed (Zhang & Knisely, 2016).
Wear Time
Optune should be worn for at least 18 hours per day for a minimum of four weeks (American Brain Tumor Association, 2014). Because the effects of TTFields are only in action when the device is on (the effects do not continue after the device is turned off), it is important to educate the patient about complying with wear time (Vymazal & Wong, 2014).

Research suggests that increased compliance of TTFields is correlated with increased overall survival of patients who are using the device (Vymazal & Wong, 2014). One study showed that patients who had a partial or full tumor response wore their devices for an average of 22 hours per day, those with stable disease wore theirs for an average of 20.4 hours per day, and those with no tumor response or stabilization had the device on for an average of 19 hours per day (Vymazal & Wong, 2014). Each month, a device support specialist visits the patient’s home and downloads the internal files from the device that tracks the amount of daily wear time of the patient (Novocure, Inc., 2015). Through this method, providers can monitor the length of time the patient’s device is active daily without risk of recall bias or inaccurate report. Patients should maximize the amount of wear time by wearing and plugging in the device when asleep (Zhang & Knisely, 2016) and taking minimal breaks from the device when awake (e.g., when exercising or showering) (Novocure, Inc., 2016a). To take a shower, the transducer arrays can be unplugged from the battery, and a shower cap can be placed over the transducers to prevent them from getting wet.

Scalp and Transducer Arrays
To not inhibit the electromagnetic field, patients must shave their scalp every few days prior to changing the transducer arrays. Transducer arrays should be changed twice weekly (at most every four days). The positioning of the transducer arrays on the patient’s scalp is determined by the healthcare provider after looking at the patient’s magnetic resonance imaging. Patients should abide to proper placement of transducer arrays based on the provider’s instructions (Novocure, Inc., 2016a). Research suggests that maximal effect on the tumor cells occurs when they are properly aligned with the electric field, but further investigation is needed in this area (Zhang & Knisely, 2016).

Monitoring for Side Effects
One of the major advantages of TTFields, aside from its efficacy, is that it has minimal side effects, the most common of which are scalp irritation and headache. Compared to previous standard therapy, TTFields monotherapy is unlikely to cause major systemic side effects associated with chemotherapy and radiation therapy, such as nausea, vomiting, and fatigue. These side effects immensely affect a patient’s quality of life while undergoing treatment (Stupp et al., 2015).

Assessment
Aside from dermatitis of the scalp and headache, patients may experience less common side effects. Nurses should inquire about any allergic reactions, malaise, muscle twitching, and skin ulcers that the patient is experiencing. In addition, periodic complete blood counts should be obtained during temozolomide treatment. When TTFields was used in conjunction with temozolomide, 10% or greater of patients reported low platelet counts (Novocure, Inc., 2016b). The nurse can also ask about unusual bleeding or bruising, nausea, constipation, vomiting, fatigue, scalp irritation, headache, convulsions, and depression (Novocure, Inc., 2016b).

Physical Side Effects
Nurses should carefully examine the patient’s scalp for any rashes, sores, blisters, or other lesions. Although skin irritation with TTFields is generally reversible, symptoms can worsen if not treated. Nonprescription topical steroids, such as 0.1% hydrocortisone cream, are commonly used to treat skin irritation (Novocure, Inc., 2016a).

Conclusion
TTFields have been of interest to healthcare providers because of the promising results the therapy has shown in treatment of new onset and recurrent glioblastoma. When compared to traditional therapy, correct use of TTFields yields better outcomes in terms of patient survival and quality of life. It is the responsibility of nursing professionals to ensure that patients are maximizing the efficacy of TTFields and recognizing any adverse side effects of therapy, so they can be addressed.

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REFERENCES


