Case Report

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Impact of Intravenous Vitamin C and Endolaser Therapies on a Pediatric Brainstem Glioma Case

Ivette M Solís-Nolasco, BSc[1], Gilberto Caraballo, MD[2], Michael J González, DSc, NMD, PhD[3], José Olalde, MEE[2], and Raul H Morales-Borges, MD[4]

Abstract
Pediatric cases of a brainstem glioma are one of the most difficult tumors to treat. In children, this type of cancer is perhaps the most dreaded of cancers due to its poor prognosis, yet it remains an area of intense research. In the case presented herein, conventional chemotherapy and radiotherapy treatments were not showing any improvement. The patient was then treated with high-dose intravenous vitamin C (IVC) and endolaser therapy. A significant reduction in glioma's size was achieved in 2 months with this adjunct therapy. These results present a possibility of decreasing brainstem glioma progression with adjuvant IVC and endolaser therapy.

Keywords
brainstem glioma, pediatric cancer, intravenous vitamin C, intravenous laser therapy

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Case Background

In the case presented herein, we discuss the effect of intravenous vitamin C (IVC) and endolaser therapy in a 6-year-old female child with a brainstem glioma. From 15% to 20% of all central nervous system, tumors in children are brainstem gliomas.[1] The statistics of survival for this condition have not improved over the years. The symptoms of brainstem glioma are headache, vomiting, motor weakness, and hearing impairment.[2]

In most cases, it is a tumor difficult to resect; for that reason, the evaluation of other clinical approaches is necessary.[3] Intravenous (IV) administration of ascorbate can act as a prodrug to deliver a significant influx of H_2O_2 to tumors.[4] H_2O_2 is the principal mediating factor in cytotoxicity to cancer cells via IVC.[5] Vitamin C promotes an intracellular oxidation state and energy generation that improves overall therapeutic potential including stimulation of processes such as apoptosis and necrosis.[6]

In combination with IV laser therapy, it is possible to activate mitochondrial metabolic pathways and increase production of ATP.[7] Each laser color applied therapeutically provides wavelengths capable of influencing different cellular and physiological aspects, among them, energy, oxygenation, circulation, and reduction in blood pressure among and others.[8]

Case Presentation

A 5-year-old child, with a weight of 59 pounds and height of 3′10″, presented in a computer tomography (CT) scan with contrast a neurohypophysis bright spot and a heterogeneous mass at the brain stem, classified as

[1]Department of Interdisciplinary Studies, College of Natural Sciences, University of Puerto Rico, Río Piedras Campus, Río Piedras, Puerto Rico
[2]Centro Medico Regenerativo, Bayamon, Puerto Rico
[3]Department of Human Development, School of Public Health, University of Puerto Rico, Medical Sciences Campus, San Juan, Puerto Rico
[4]Integrative Optimal Health of Puerto Rico, San Juan, Puerto Rico

Corresponding Author:
Michael J González, Department of Human Development, School of Public Health, University of Puerto Rico, Medical Sciences Campus, San Juan, Puerto Rico.
Email: michael.gonzalez5@upr.edu

brain stem glioma. In January 2018, the measurements of the mass were $4.6 \times 2.9 \times 2.7$ cm ($36.018\ cm^3$). The patient received chemotherapy (carboplatin and vincristine). Carboplatin was administered by a 1-hour infusion at a dose of $175\ mg/m^2$ for 4 consecutive weeks, followed by a 2-week rest period, and then reinstituted for 4 more weeks. Vincristine at a dose of $1.5\ mg/m^2$ (maximum dose 2 mg) was administered by IV bolus weekly for 10 weeks, concurrent with the carboplatin and 30 radiotherapy treatments (60 Gy given locally to the primary tumor site in single daily fractions). In April 2018, a CT scan showed a 55% reduction in size with measurements were $2.9 \times 2.7 \times 2.6$ cm ($20.358\ cm^3$). Nevertheless, the patient started to lose control of foot movement. At this point, the patient was restarted on chemotherapy-only treatment.

Another CT performed 4 months later in August 2018 showed that the measurements of the brainstem glioma were $4.9 \times 3.1 \times 3.8$ cm ($57.722\ cm^3$). The 285% increment in size showed that after the 30 chemotherapies and 30 radiotherapies plus chemotherapy-only treatments resulted only in a transitory response. Given the poor improvement, the patient started IVC and endolaser therapy. For vitamin C, the dose was 25 g in 250 mL ringers lactated ringer's solution, and for endolaser therapy, the colors given were green, blue, red, and yellow with a 20 Hz frequency/wavelength 10 minutes each. The patient received the treatment twice a week for a total of 18 treatments.

After starting with IVC and laser therapy for a period of 2 months, in October 2018, a CT showed a 79% decrease in the size of the brainstem glioma. The measurements were $2.9 \times 2.2 \times 1.9$ cm ($12.122\ cm^3$). The brainstem glioma was causing less extrinsic impression upon the fourth ventricle anterior aspect. This result revealed that the brainstem glioma that was previously diagnosed with a fatal prognosis was significantly reduced after IVC and endolaser therapy.

Discussion

The IV delivery of pharmacological ascorbate as an adjuvant can eliminate cancer cells by the increased production of H_2O_2.[4] Eliminating sugar ingestion concomitant to receiving IV doses of ascorbic acid (AA) increases the effectiveness of this therapy. Vitamin C is structurally similar to glucose, the main source of energy for the cancer cell. AA is not cytotoxic toward normal cells, but it shows cytotoxicity to cancer cells.[9] This is due to the content of enzymes glutathione peroxidase, catalase, and superoxide dismutase in normal tissue.

In addition to IVC, we included IV laser therapy to the treatment to enhance the therapeutic effectiveness. Laser light can activate microcirculation, regeneration, and energy production.[10] Red laser light helps in tissue regeneration and yellow laser light helps in detoxification. Blue and green laser lights have anti-inflammatory effects, which helps in acute pain.[11] When receiving IV laser therapy hypoxia of the tissue is improved, which leads to a normalization of the tissue metabolism. Furthermore, it causes an increase of ATP-synthesis with a normalization of cell membrane potential.[7] Regarding the mechanism of action of the combination of photodynamic laser therapy (PDLT) and AA in cancer, there are 2 studies that show a synergistic effect. One study[12] demonstrated that PDLT can cause Fe and Cu ions to be released from their protein complexes. The reactions between the ions and ascorbate resulted in a post-PDLT surge in reactive oxygen species (ROS). This ultimately leads to enhanced tumor cell death, thus an improved treatment outcome. Based on the results that PDLT induces metal ion release and ascorbate reacts with the metal ions producing subsequent ROS, an internal related, complementary, and synergistic tumor treatment can be accomplished by combination of both PDLT and AA, as a low-toxicity and effective method. A second study[13] was with bladder cancer and PDLT was performed by intravesical instillation of hematoporphyrin derivative PsD-007 containing AA followed by whole bladder wall laser irradiation, and they found a reduction in tumor recurrence (23.3% vs 54%) on follow-up for 30 months after PDLT. This method was effective in the prevention of bladder cancer recurrence.

The metabolic corrections induced by vitamin C and laser therapy could lead to a multifunctional recovery that may result in a decrease in tumor growth. Combining IVC and endolaser therapies, we have a better chance to reduce the progression of the glioma.

Conclusion

Application of IV AA in cancer patients might provide them with better quality of life and increases the possibility of therapeutic improvement. Cancer patients have depressed circulatory, cellular, and tissue ascorbate levels and reserves.[14] The high-dose IVC therapy will correct those identified deficiencies. IV laser therapy improves cell energy, blood, and cell properties that enhance therapeutic outcomes. Combining IVC with endolaser as adjuvant therapies, we achieved a significant reduction in tumor size. This clinical therapeutic approach for glioma could be utilized as an adjuvant therapy for this deadly type of cancer.

Declaration of Conflicting Interests

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ORCID iD

Raul H Morales-Borges https://orcid.org/0000-0002-3469-3074

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