USE OF GAMMA KNIFE IN RADIOSURGERY IN THE TREATMENT OF EPILEPSY

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Epilepsy is a group of neurological disorders: structural, biochemical or electrical anomalies of nerve cells characterized by epileptic seizures. These seizures are caused by abnormal activity of neurons of the brain, which can lead to disruption of cognitive and motor functions, neurodegeneration of brain tissue and even death without proper treatment.

According to the World Health Organization (WHO), as for 2017, around 50 million people suffer from epilepsy throughout the world. In this regard, epilepsy is one of the most spread neurological diseases on a global scale.

Keywords: epilepsy, pharmacoresistance, radiosurgery, Gamma Knife, ionizing radiation.

There are many ways to treat epilepsy: antiepileptic drugs (Phenobarbital, lamotrigine, perampanel, etc.), dietary treatment (ketogenic diet), surgical treatment, neurostimulation and neuromodulation (electrical stimulation of the vagus nerve), radiosurgery.

Every third case of epilepsy is drug resistant (pharmacoresistant), which presents a complex choice of treatment methods. In connection with it, patients has to resort to surgical intervention: removal of the epileptic region of the brain without any subsequent significant disorders of consciousness and motor functions. In some cases, simple surgery cannot solve the problem due to the difficult location of the abnormal site or close contact with the cortical area, whose removal will result in loss of sensory processing, linguistic capacity or paralysis.

Radiosurgery is an alternative to surgical treatment in complex cases of benign and malignant tumors, arteriovenous malformations, metastases, meningiomas, trigeminal neuralgia, as well as epileptogenic brain damage in patients with a pharmaco-resistant form of epilepsy. In radiosurgery, innovative devices are used where focused converging narrow ionizing beams are used to induce the desired biological effect at a predetermined target through intact skull and brain tissue. A sharp drop in the dose outside the target ensures optimal preservation of surrounding tissues.

Gamma Knife is the most famous device in radiosurgery among other devices. It was invented in the 1950s, and widely used in the 1970s in oncology. Thanks to the development of computer technology and diagnostic methods (MRI, CT, PET), the Gamma Knife is still used, even despite the development of other promising radiosurgical systems, such as the cybernetic robotic radiotherapy system based on linear accelerators.

The advantage of the Gamma Knife, as well as of all radiosurgery, is the avoidance of damage to the outer covers or craniotomy, and there is also no damage to neighboring healthy cells located next to the abnormal area. Gamma Knife treatment is based on the ability to focus ionizing radiation of cobalt-60 in doses of 10–50 Gy (depending on the nature of the lesion) on small clearly defined areas of tissues of deep or hard-to-reach areas of the brain.

The development of radiation diagnostics, radiosurgery and radiotherapy makes it possible to detect and treat difficult operable tumors and epileptic structures of the brain difficult for ordinary surgery. Still there are many nuances associated with the uniqueness of each case, the selection of appropriate technical parameters (dose, volume goal, etc.) and the development of highly functional computers that should be studied and overcome in this promising method of treatment. However, the important role of radiosurgical methods in the treatment of oncological diseases and epilepsy is already clear.

APPLICATION OF LASERS IN VISION CORRECTION

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The paper considers the main methods of vision correction used in ophthalmology, compares the mechanisms of vision correction and their possible side effects, studies the prospects of this direction of medicine.

Keywords: laser radiation, correction of vision, choriodea, miopia, hypermetropy, sculter.

The laser is a source of monochromatic coherent light with a high directionality of the light beam. The laser beam has hemostatic properties, produces a bloodless incision while simultaneously destroying the pathogenic microflora and tumor cells in the operating wound.

There are 2 main pathologies of vision-myopia and hypermetropia, the correction of which is carried out using different lasers. Treatment can be as conservative: glasses, gymnastics, nutrition, lighting mode, metered eye strain, etc., and surgical with the use of various laser devices, which in turn are divided into excimer laser units (Lasik method) and femtosecond lasers (PRK method).

LASIK is a unique combination of microsurgical and excimer laser technologies. This is the most "sparing" and effective method that preserves the anatomy of the corneal layers.

PRK-dosed removal of the corneal tissue by evaporation using an excimer laser, is a non-contact action of the excimer laser on the surface layers of the cornea, without affecting other structures of the eye. At the same time, the laser, working in the scanning mode, "smoothes out" and "simulates" its surface, with the advent of "microerosion".

If we compare these two methods, then in the case of hyperopia, LASIK is uniquely the best method. The thin cornea in some cases does not allow correction by LASIK, so the only option is PRK. In the case when the microkeratome can not be used for one reason or another, PRK is again the only option. In all other cases, LASIK is the preferred option.

Every year, several million laser sight correction operations are performed worldwide, and numerous private clinics convince patients of the absolute effectiveness and safety of this procedure, but is it so?

Here are a number of side effects of these operations: dry eye syndrome, the appearance of asterisks and luminous circles before the eyes, the disturbance of night vision, a decrease in contrast sensitivity, a decrease in the ability to distinguish between the outlines of objects and the color range is one of the most important functions of vision. It should be understood that the operation thins the corneal layer and reduces its resistance to external influences.

There is also the risk of appearance and operational complications, which are most often associated with the technical maintenance of the operation: loss of vacuum or its failure during shear, blade defects, incorrectly selected parameters of vacuum rings and stoppers, and postoperative complications, which include a large number of conditions: from inflammatory reactions to subjective dissatisfaction of the patient with the result of the operation.

If you summarize all the complications, deviations from the normal course and side effects of LASIK, you will get 18,61 %. Quite often they are combined in one patient. For example, the uneven slice of a microkeratome with an epithelial defect during surgery can lead to the growth of epithelium in the postoperative period, which in turn can lead to the occurrence of induced or incorrect astigmatism, and, consequently, reduced visual acuity. Complications that affect the visual result in the long-term postoperative period, after reoperations (the total of reoperations – 12,8 %), was 0,67 %.

Every year, several million laser sight correction operations are performed worldwide, and numerous private clinics convince patients of the absolute effectiveness and safety of this procedure, but is it so?

PROSPECTS OF USING CPG-DNA AND CYCLIC DINUCLEOTIDES AS VACCINE ADJUVANTS

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Owing to insufficient immunogenicity of modern vaccines they need to be complemented with adjuvants. The canonical adjuvants induce a humoral, rather than cellular immune response essential for control of viruses and tumors. It is known that nucleic acid compounds, such as CpG-DNA and cyclic dinucleotides (cyclic diGMP, cyclic diAMP, etc.) are the agents capable to stimulate both humoral and cellular immune response to pathogens and own transformed cells. The prospects of using the above mentioned nucleic acid compounds for treatment of cancer are of particular importance.

Keywords: adjuvants, CpG-DNA, cyclic dinucleotides, *in situ* vaccination