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New indications of radiosurgery in the central nervous system

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INTRODUCTION

The precision of radiosurgery was conceived to make precise and well-circumscribed lesions in the brain. Then, in 1951, the goal was disconnections of pathways and destruction of nuclei to modify undesired central nervous system (CNS) function, chiefly pain and ill behavior. The precision mimicked the neurosurgeon's using the scalpel, or techniques then accepted for functional neurosurgery, cryo- and radiofrequency stereotactic lesions, hence the name Gamma Knife.

APPLICATIONS

The precise technique developed by Dr. Lars Leksell, was applied to benign and oncological pathologies when they became discretely seen with computerized images. AVMs were however treated earlier due to their stereotactic visualization with conventional angiography. It was a great step into understanding radiation cell function modification. Growth factors (GF) induced repair reaction triggered in the vessel wall became classical example of this radiation effect. Dr. Barcia-Salorio from Valencia used this cell modification function effect of radiation to halt hippocampal epileptic focus. He aimed still maintain functional the hippocampus. His initial animal experimentation and human trials confirmed this possibility. The successful AVMs obliteration with radiosurgery in patients with epilepsy showed the effects not only in the AVMs, but also halting seizures in the majority of them.

FUTURE

Exploring the concept of cell function modification led to several questions needing answers: Does focus radiation induce immunological reaction in tumors? - Abscopal Effect. Does induction of repair reaction in the areas of cell degeneration lead to recovery of cell groups? Examples are Substantia Nigra cells to produce dopamine in Parkinson's disease, Basal Nucleus of Meihart cells to produce acetylcholine in Alzheimer's disease, hypothalamic cells modification in Morbid Obesity. Indeed, learning radiation cell modification effects will open up applications that are not reality at this time. Thinking of the development of Radiosurgery beyond the brain, it is already a clinical reality. It modified the direction of conventional radiation therapy. The ideas above will likely become reality for treatment of pain and other diseases in the spinal cord, peripheral nerves and peripheral ganglia. They also will be applied to other areas of the body, beyond the CNS.

CONCLUSION

Radiosurgery is well established to treat tumors throughout the body. It modified the course of radiation therapy towards hypofractions. It has given security to neurosurgeons to perform partial resections and complement surgery with the precision that is part of their specialty. It gave the opportunity to radiation oncologists to hone in their concepts of fractions, diving into hypofraction schemes. These concepts have challenged the medical physicist to improve beyond imagination the radiation techniques. Future is unpredictable, but we will be entertained during the coming years with hypofractions and cell modification possibilities.