# RADIONUCLIDE IMAGING IN THE DIAGNOSIS OF INTRACRANIAL NEOPLASMS OF CHILDHOOD.

Essay

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By

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# CONTENTS

Page

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# I- INTRODUCTION

# RADIONUCLIDE IMAGING IN THE DIAGNOSIS OF INTRACRANIAL NEOPLASMS OF CHILDHOOD

## I- Introduction:

Intracranial tumors constitute the most frequent malignancy in children aged 1-14 years. Approximately 70% of verified tumors in children are gliomas, low grade astrocytomas and medulloblastomas, each constitutes a greater proportion of the glioma series. Neoplasms of the posterior fossa account for approximately one half of all pediatric intracranial neoplasms. Brain isotopic imaging cannot be expected to answer all questions possed in the evaluation of brain tumors of childhood, however radionuclide cerebral perfusion and static imaging are accepted screening procedures that are now widely used with no patient morbidity.

Children with the earliest of neurologic symptoms or behaviour disorders can be studied. Tumors involving the brain parenchyma, both primary and metastatic, and those of nerve sheath origin, such as acoustic neuromas, are probably visualized on static imaging because of entery of radionuclide into the tumor cells themselves. This radionuclide accumulation in the tumor cell occurs gradually over a period of time of maximum tracer accumulation which may be 3 or more hours. This is, in part, the reason for doing delayed imaging for brain tumor detection. Depending on the blood supply, tumors of the brain parenchyma and those of nerve sheath may or may not be seen on the blood flow study.

Brain isotope scan, also plays an important role in the postoperative period in demonstrating the resolution of the lesions, the response to therapy and the evaluation of new lesions.

This essay reviews those instances where radionuclide brain imaging has shown particularly good specificity; in addition, highlights the use of brain isotopic scan in the diagnosis of intracranial neoplasms of childhood. Serial scintigraphy will be demonstrated in some evaluable cases.

# II- ANATOMY AND PHYSIOLOGY OF THE BRAIN

## II Anatomy and Physiology of the Brain:

The functions of the body are under the control of both the nervous and endocrine systems. The nervous system is the computer of the body and it controls the rapid activities of it which include muscular contraction, perception of changing visual events and the secretion rates of endocrine glands (Early, et al., 1979).

The nervous system has a sensory division and a motor division, the cerebral cortex integrates the body's higher functions; most of the cerebral cortex is located in the cerebral hemispheres.

### Cerebral Hemispheres:

A large portion of the brain is made of the two cerebral hemispheres, they are separated by the longitudinal cerebral fissure. An extension of the dura mater forms the falx cerebri which projects into the longitudinal cerebral fissure. The cerebral hemispheres have dorsolateral, medial and basal surfaces, which contain many grooves known as fissures and sulci. The part of the brain between the grooves is known as convolutions, or gyri. The cerebral hemispheres are divided into 4-lobes: Frontal, parietal, occipital, and temporal.

The lateral cerebral fissure separates the temporal from the frontal lobe. The central sulcus (Fissure of Rolando) separates the frontal from the parietal lobe; the occipital lobe is separated from the parietal lobe by the parietal occipital fissure which passes along the medial surface of the posterior portion of the cerebral hemisphere. The cerebral cortex has an area of approximately 220,000 $mm^2$, and not more than one third of this area lies on the free surface or crown of the convolutions.

The total number of nerve cells in the human cerebral cortex has been estimated at between $7X10^9$ and $14X10^9$. There are approximately 200 million nerve fibres that are received from and projected to the lower levels of the nervous system.

**Functions:**

The posterior portion of the frontal lobe, the so called prefrontal cortex of man; affects the motor system. This posterior portion is called the motor cortex, and it controls discrete voluntary movements of skeletal muscles. Both the right and left sides of the motor cortex control each others. The parietal lobe receives the somatic sensory messages and it is also the part of the brain that receives sensations of stereoperception and can discriminate between differences in weight, texture and position. The temporal lobe is concerned with hearing and it is necessary to recognize and organize langauge. The occipital lobe is mainly related to vision. The nerve fibres that end in the cerebral cortex cross in the brain stem; therefore lesion in the left side of the cerebral cortex is recognized in the opposite extremities.

**Basal Ganglia:**

They are masses of gray matter situated deep within the cerebral hemisphere.

**Function:**

They exert an important regulating and controlling influences on motor integration. This area of the brain may also inhibit somatic reactions initiated by the cerebral cortex.

**Thalamus and Hypothalamus:**

The thalamus is a large ovoid gray mass located