MANAGEMENT OF BRAIN STEM GLIOMAS

Thesis
Submitted for Partial fulfillment of
M.D. in Neurosurgery

By
Waeel Ossama Sayed Ahmad
- M. Sc. Cairo 2006 -

Under supervision of

Prof. Dr. ABD EL ALIM A. RAGAB
Professor of neurosurgery – Cairo University

Prof. Dr. NASSER M. F. EL GHANDOUR
Professor of neurosurgery – Cairo University

Prof. Dr. WAEL MOKHTAR EL MAHDY
Professor of neurosurgery – Cairo University

Faculty of Medicine
Cairo University
2010

بِسْمِ اللهِ الرَّحْمنِ الرَّحِيمِ

" وَقُل رَّبِّ زِدْنِى عِلْماً"

صدق الله العظيم

[سورة طه (الآية 114)]

ACKNOWLEDGMENT

The sincere and honest help of many people, made it possible for this work to be accomplished. I wish to thank them all, even though I can list only a few names.

Production of this thesis wouldn't have been accomplished without the prodigious fatherly guidance, great support, constant encouragement and experienced advice of **Prof. Dr. Abd El Alim A. Ragab** (professor of neurosurgery, Cairo University), for whom I would like to express my deep gratitude and appreciation.

And I am very thankful to **Prof. Dr. Naser M. Fathy El Ghandor** (professor of neurosurgery, Cairo University), for his unstinted help, careful supervision, reliable advice and giving me the honor to be his student. And also for taking the main burden of revising the present work.

And I would like to express my deepest and sincere thanks to **Prof. Dr. Wael Mokhtar El Mahdy** (professor of neurosurgery, Cairo University), to whom I am very much grateful for his contributions and enthusiastic help.

Also, I would like to express my special thanks to **Prof. Dr. Ahmad M. Issa** (Professor and Head of Neurosurgery Department, Faculty of Medicine, Cairo University), for his support and encouragement.

As for the patients whom their medical conditions founded the basis of our study; I would like to dedicate them these words by Sir William Osler 1849-1919, Prof. of medicine, Oxford, England, " *To study the phenomenon of disease without books; is to sail an uncharted sea, while to study books without patients; is not to go to sea at all.*" . May God bless and cure them all.

Also, I would like to thank all my Professors and Colleagues in the Department of Neurosurgery, Cairo University who have encouraged, teached and assisted me.

Finally, Thank you ALLAH for providing me with the help, patience and support of my family, my wife and my little son.

INDEX

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

- **%** : percent
- **&** : and
- **Ant:** anterior
- **C.L** : conscious level
- **C.P:** cysto-peritonial
- **C.T** : computed tomography
- **cm** : centimeter
- **d** : day
- **e.g** : "exempli gratia" for the sake of example
- **et al** : "et alii" and others
- **etc** : "et cetera" and so on
- **ETV**: endoscopic third ventriculostomy
- **Fig.** : figure
- **FLAIR** : fluid attenuated inversion recovery
- **FSE** : fast spine echo
- **Gd** : gadolinium
- **GKS:** gamma knife surgery
- **hr** : hour
- **HCP:** hydrocephalus
- **i.e** : "id est" that is to say
- **Lt**: left
- **m** : meter
- **M.I:** mitosis index
- **M.R.I** : magnetic resonance imaging
- **min** : minute
- **mm** : millimeter
- **mon** : month
- **Post:** posterior
- **Rt:** right
- **SE** : spine echo
- **sec** : second
- **STIR** : short tau inversion recovery
- **T 1**: time to magnetize (spin lattice relaxation time -regrowth)
- **T2** : time to demagnetize (spin spin relaxation time – decay)
- **T I** : time to inversion

- **T WI** : T weighted image
- **TE** : time to echo
- **TR** : time to repetition
- **TSE** : turbo weighted spine echo
- **VP**: ventriculo-peritonial
- **W**: wee
- **yr** : year

ABSTRACT & KEY WORDS

For years, patients with brain stem gliomas have been a challenge for neurosurgeons until recent new diagnostic , surgical & treatment tools provided better outcome regarding increasing management benefits and decreasing its complications.

The aim of this thesis is to clarify these different management tools and their indications and to state their efficacy. Also to highlighten its application and practice in Egypt.

(Key Words: Brain tumors - Brain stem – gliomas**)**

INTRODUCTION

The brain stem is a mass of nervous tissue connecting the cerebral hemispheres with the spinal cord. Beside acting as the sole bridge between brain and the spinal cord, it also harbors vital centers for respiration and circulation, as well as most cranial nerves nuclei. *(McMinn, 1990).*

Historically, brain stem gliomas were viewed with sense of hopelessness. . In the past, the risk of operating on the brain stem together with the failure of surgery to alter prognosis led to the recommendation that these tumors be treated with conventional radiotherapy and supportive measures alone. And was once stated that "until some effective treatment other than surgery is advised, gliomas of the brain stem are hopeless problems for treatment". *(Bailey & Buchanan, 1939)*

The treatment of brain stem gliomas has evolved in a progressive yet radical manner over the past few decades. This evolution in management has been catalyzed by a revolution in imaging technology, microsurgical techniques, neuronavigation facilities, new radiotherapy methods & pathological sub-grouping with relevant different prognosis. *(Hoffman et al, 1996)*

Perhaps the most important contribution to the management of brain stem gliomas is the recognition that they should not be considered together as a single entity, but be treated according to the tumor location and anticipated biological activity. *(Poe L.B 1996).*

In the past, these tumors came to be viewed as a homogenous group due to the lack of sensitivity of the pre-computed tomography (CT) imaging technology. *(Ragheb et al., 2000).*

Brain stem tumors may now be reliably classified into subgroups based on their imaging characteristics in the MRI and CT and clinical presentation. They are broadly divided into diffuse, focal, exophytic and cervicomedullary types.

These subgroups have relevance with respect to treatment, pathology and prognosis, and help separate patients who may benefit from surgery from those in whom surgery is best avoided. *(Ragheb et al., 2000)*

It is therefore essential that a careful pre-operative assessment is made with regard to the clinical course of the patient and the tumor appearance on neuro-diagnostic imaging. This reliably predicts the biological activity of the tumor and helps in the selection of patients who will benefit most from surgery.

The attitude that all brain stem gliomas carry a dismal prognosis and are inoperable has therefore been replaced with an approach that brain stem gliomas are a diverse group of tumors, many of which are operable and carry a good prognosis. *(Hoffman and Goumarnova, 1996).*

Management options for brainstem gliomas include: surgical intervention (may be in the form of direct surgery to the tumor aiming for

resection, biopsy of the tumor whether open or stereotactic or endoscopic, or surgery for CSF diversion), radiotherapy, chemotherapy and immunotherapy. *(Albright, 2005).*

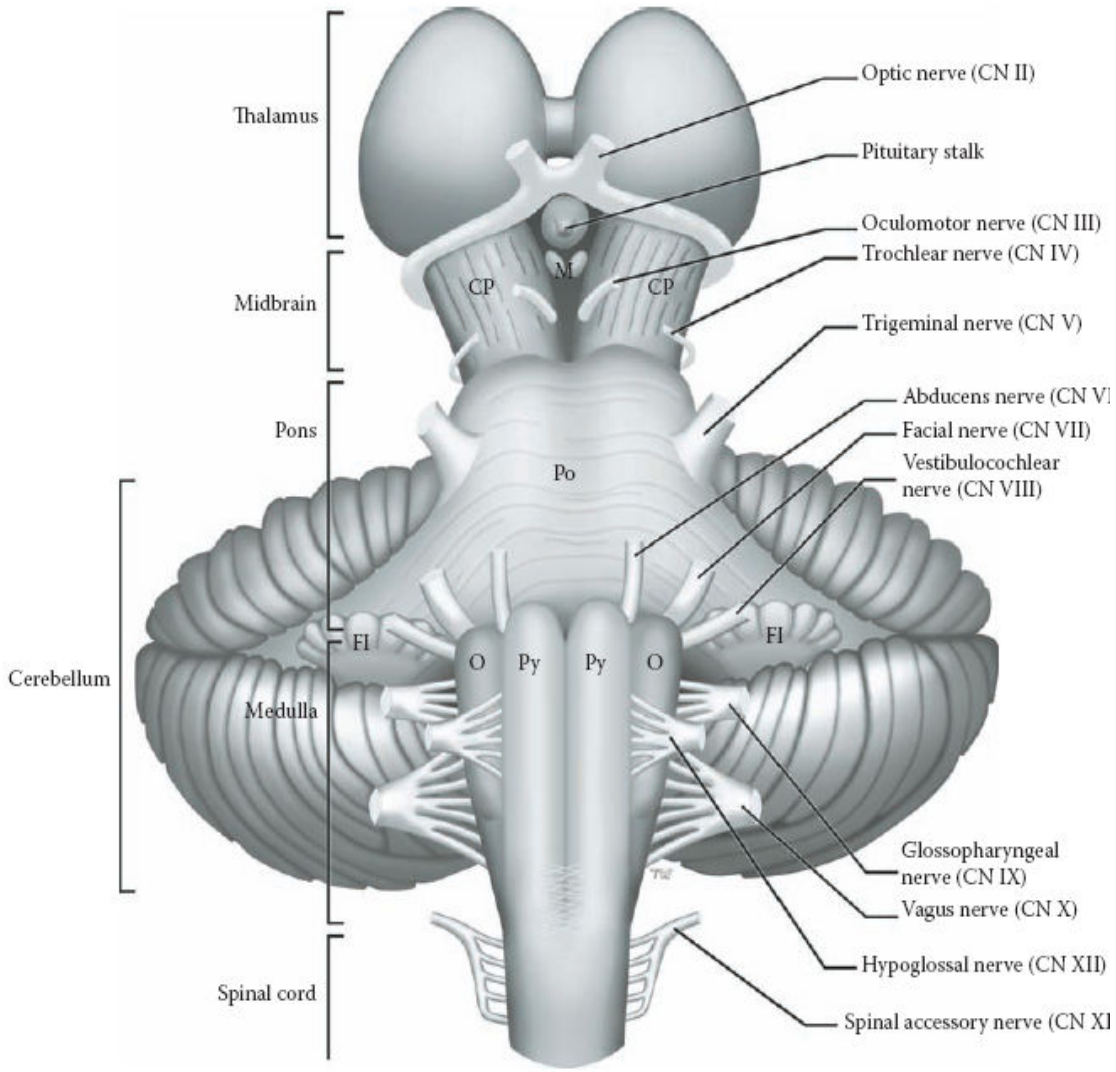
AIM OF WORK

- Reviewing the literature regarding the anatomy of the brain stem, the pathology, clinical presentation and investigations for brain stem gliomas. Also the literature is reviewed for the different modalities used in the management of patients with brain stem gliomas.
- Stating and clarifying that based on clinical presentation, MRI characteristics & understanding surgical anatomy with pathology, it will be possible to assess the most appropriate group of patients in whom different forms of surgery, radiotherapy or chemotherapy would be beneficial.
- Following the different management plans applied for the included studied cases; the chosen treatment line , any complications met, their relation to available facilities & equipments and their effect on follow up outcome.
- Pointing out recommendations for outlining up-dated decision-taking algorithms, best use of available facilities and their needed upgrading.

REVIEW OF LITERATURE …. ANATOMY

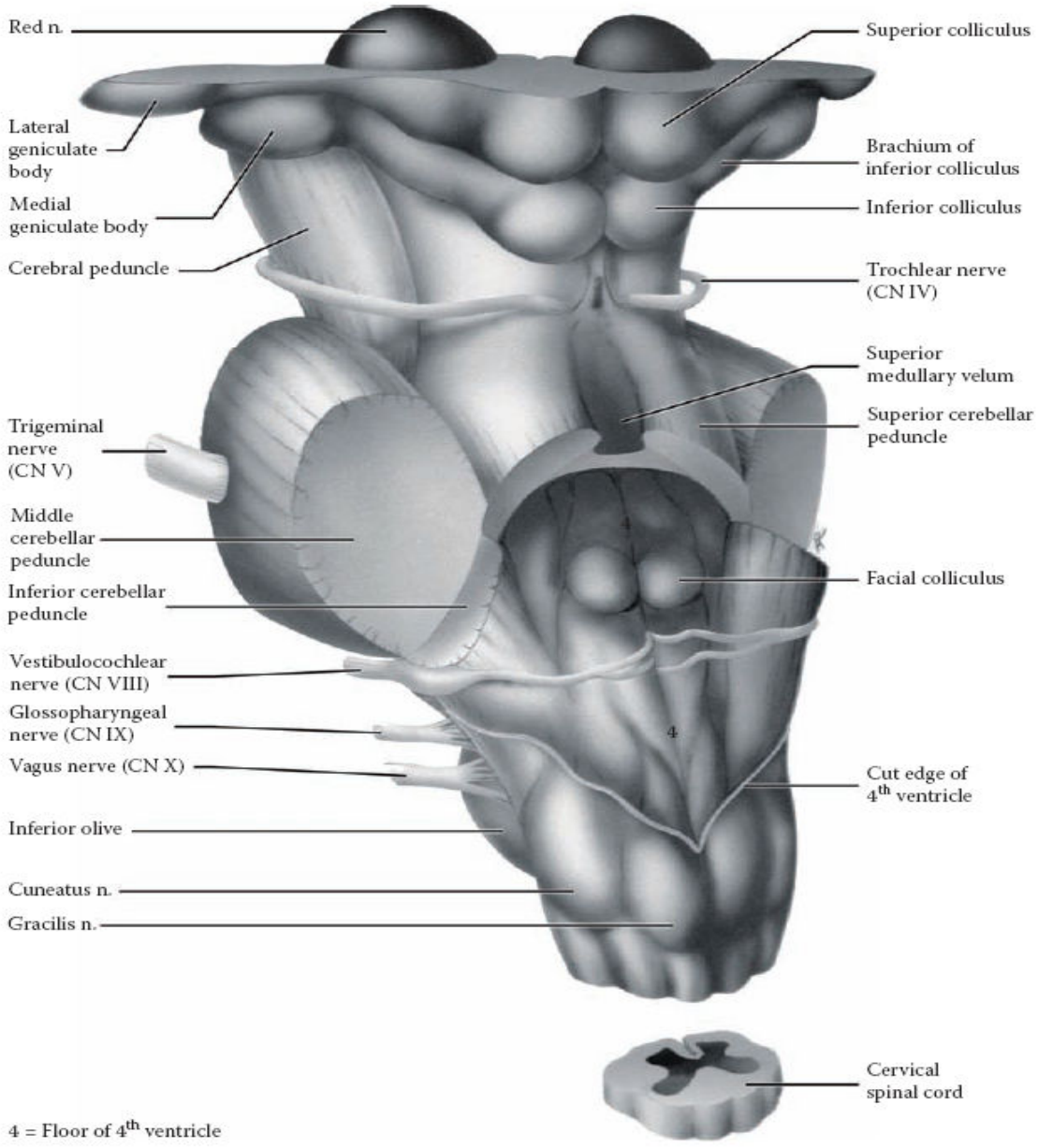
- **Embryological development**
- **Regions of the brainstem**
- **Reticular formation**
- **Blood supply**
- **Cranial nerves**
- **4^{th} ventricle & related cisterns**
- **Radiological appearance**

The brain stem is the part of the brain connecting the cerebral hemispheres with the spinal cord, and consists of the midbrain, pons and medulla oblongata.



(fig.1) Ventral view of the brain stem
(langman medical embryology, 2005)

It extends from just above the aperture in the tentorium cerebelli to C1 vertebra below the foramen magnum and the cerebellum projects from its dorsal surface. The medulla oblongata passes through the foramen magnum, and the change of name to spinal cord occurs where the upper most rootlets of C1 nerve emerge *(McMinn, 1990).*



(fig.2) Dorsal view of the brain stem
(langman medical embryology, 2005)