Extent of Resection and Survival in Glioblastoma Multiforme

Essay

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Ahmad Abdul-Rahman Abul-Khair

Contents

List of Abbreviations

AA	:	Anaplastic astrocytoma
ACA	:	Anterior cerebral artery
ADC	:	Apparent diffusion coefficient
AIDS	:	Acquired immunodeficiency syndrome
ALA-5	:	5-Aminolevulinic acid
AVM	:	Arteriovenous malformations
BBB	:	Blood brain barrier
BBTB	:	Blood brain tumor barrier
BCNU	:	Bischloroethylnitrosourea
BIS	:	Bispectral index
BNCT	:	Boron neutron capture therapy
BOLD	:	Blood oxygen level dependent
BTSC	:	Brain tumor stem cells
CC	:	Corpus callosum
CECT	:	Contrast enhanced computerized tomography
CNS	:	Central nervous system
CSF	:	Cerebrospinal fluid
CTL	:	Cytotoxic T lymphocyte
DSA	:	Digital subtraction angiography
DTI	:	Diffusion tensor imaging
DTI	:	Diffusion tensor imaging
DWI	:	Diffusion-weighted imaging
EOR	:	Extent of resection
FasL	:	Fas ligand
FIGS	:	Fluorescence image guided surgical resection
fMRI	:	Functional magnetic resonance imaging
GBM	:	Glioblastoma multiform
GFAP	:	Glial Fibrillary Acidic Protein
GTR	:	Gross total resection
HGGs	:	High grade gliomas
HLA	:	Human leukocyte antigen
HPD	:	Haematoporphyrin derivative

List of Abbreviations (Cont.)

HSV-1	:	Herpes simplex virus-1
ICP	:	Intracranial pressure
IDH1	:	Isocitrate dehydrogenase 1
iMRI	:	Intraoperative MRI
IMRT	:	Intensity modulated radiation therapy
IORT	:	Intraoperative radiation
KPS	:	Karnofsky Performance Status Scale
MCA	:	Middle cerebral artery
MGMT	:	O6-methylguanine-DNA methyltransferase
MRS	:	Magnetic resonance spectroscopy
NAA	:	N-acetyl aspartate
NECT	:	Non enhanced computerized tomography
NF1	:	Neurofibromatosistype 1
NF2	:	Neurofibromatosis type 2
NSC	:	Neural stem cells
NTR	:	Near-total resection
PCA	:	Posterior cerebral artery
PDGFRA	:	Platelet-derived growth factor receptor
PDT	:	Photodynamic treatment
PET	:	Positron emission tomography
PNET	:	Primitive neuroectodermal tumor
PNS	:	Peripheral nervous system
PTEN	:	Phosphatase and tensinhomologue from chromosome 10
rCBV	:	Relative cerebral blood volume
RT	:	Radiation therapy
SRS	:	Stereotactic radiosurgery
STR	:	Subtotal resection
TCGA	:	The Cancer Genome Atlas
TGF-β2	:	Transforming growth factor
TMZ	:	Temozolomide

List of Abbreviations (Cont.)

TP53	:	Tumor protein
VEGF	:	Vascular endothelial growth factor
WHO	:	World Health Organization

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Introduction

Glioblastoma is a cancerous brain tumor thought to be developed from astrocytes. It is both the most common and the most aggressive malignant primary central nervous system (CNS) tumor in adult. (1)

The aetiology of glioblastoma is still not well understood. Most glioblastoma tumors appear to be sporadic, without any genetic predisposition. Glioblastomas can be subdivided into primary and secondary glioblastomas. Primary glioblastomas occur de-novo without preceding lower grade astrocytomas. They tend to occur in older individuals. Secondary glioblastomas arise as malignant degeneration of lower grade tumors. They occur in younger individuals.

Histopathologically, glioblastomas are diffuse intra-axial brain tumors largely made up of neoplastic cells resembling primitive astrocytes. According to WHO classification; glioblastomas are grade IV.

The symptomatic presentation of glioblastoma can be divided into two coexistent categories:

1. Non-specific symptoms of elevated intracranial pressure (ICP) which include headache, drowsiness, visual obscurations, nausea, vomiting, nuchal rigidity, papilledema, and occasionally 6th nerve palsy.

2. Site-specific symptoms vary by tumor location and include motor, sensory, visual, language, and speech disturbances, seizures. Hearing and gait abnormalities may also been seen.(2)

Definitive diagnosis of a suspected glioblastomas on CT or MRI requires a stereotactic biopsy or a craniotomy with tumor resection and pathologic confirmation. Treatment

requires effective teamwork from neurosurgeons, neuro-oncologists, radiation oncologists, physician assistants, social workers, psychologists, and nurses. A supportive family environment is also helpful. The key reason for the lack of successful therapy is the infiltration of single tumor cells into the surrounding brain parenchyma cells, preventing complete glioblastoma resection.

The treatment of glioblastoma can be subdivided into:

(1) Symptomatic therapy:

- **Corticosteroids:** usually dexamethasone can reduce peritumoral edema,diminishing mass effect and lowering intracranial pressure, with a decrease in headache or drowsiness.
- **Antiepileptic drugs**: historically, around 90% of patients with glioblastoma underwent anticonvulsant treatment, although it has been estimated that only approximately 40% of patients required this treatment.(3)

(2) Palliative therapy:

Palliative treatment usually is conducted to improve quality of life and to achieve a longer survival time. It includes surgery, radiation therapy, chemotherapy and other novel therapies. Gross total resection of tumor is associated with a better prognosis. (4)

Surgery

Surgery is the first stage of treatment of glioblastoma. The greater the extent of tumor removal, the better. Removal of 98% or more of the tumor has been associated with a significantly longer healthier time than if less than 98% of the tumor is removed.(5)