STUDY OF EXPRESSION OF CD117 IN GLIAL TUMORS AND ITS ROLE IN TUMOUR TYPE AND GRADE

Dissertation submitted

in partial fulfilment of therequirements for the degree of

M.D. (PATHOLOGY)

BRANCH – III

GOSHEN INSTITUTE OF PATHOLOGY AND ELECTRON MICROSCOPY,

MADRAS MEDICAL COLLEGE,

CHENNAI – 600 003.

THE TAMIL NADUDR. M.G.R. MEDICAL UNIVERSITY CHENNAI

APRIL 2016

CERTIFICATE

This is to certify that this Dissertation entitled **"STUDY OF EXPRESSION OF CD117 IN GLIAL TUMOURS ANDITS ROLE INTUMOUR TYPE AND GRADE"** is the bonafide original work of **Dr.M.JAYANANDHINI,** in partial fulfilment of the requirement for M.D., (Branch III) in Pathology examination of the Tamilnadu Dr.M.G.R Medical University to be held in April 2016

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DECLARATION

I, **Dr.M.JAYANANDHINI** solemnly declare that the dissertation titled **"STUDY OF EXPRESSION OF CD117 IN GLIAL TUMORS AND ITS ROLE IN TUMOUR TYPE AND GRADE"** is the bonafide work done by me at Institute of Pathology, Madras Medical College under the expert guidance and supervision of **Prof. Dr.M.SARASWATH., M.D.,** Director, Institute of pathology, Madras Medical College.

The dissertation is submitted to the Tamilnadu Dr.M.G.R Medical University towards partial fulfilment of requirement for the award of M.D., Degree (Branch III) in Pathology.

Place : Chennai

Date: **Dr.M.JAYANANDHINI**

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Dear Dr. M.Jayanandhini

The Institutional Ethics Committee has considered your request and approved your study titled **"The Study of the Expression of CD 117 in Glial Tumors and its Role in Tumor type and Grade" No.07102014.**
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We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

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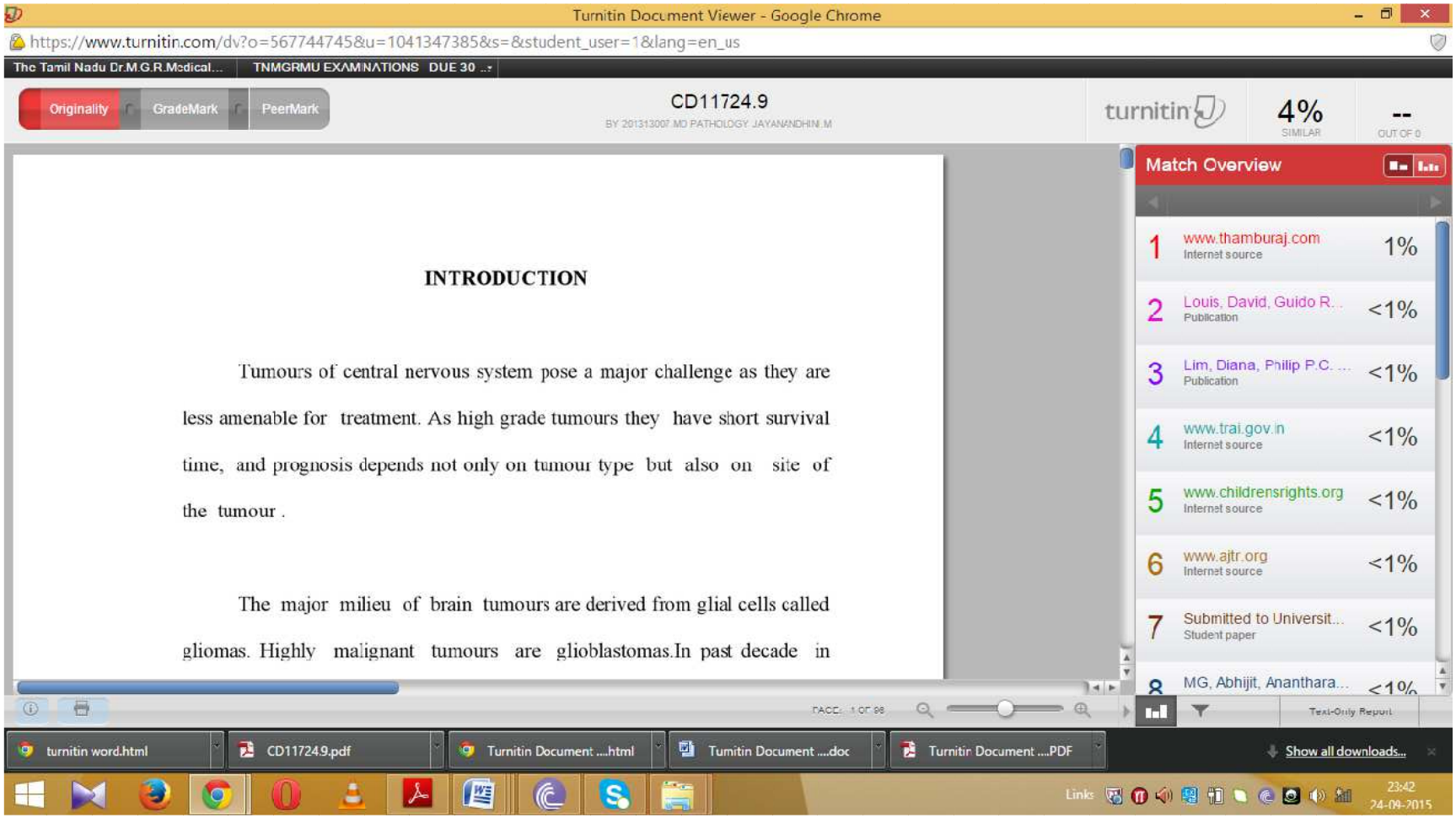
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INTRODUCTION
Tumours of central nervous system pose a major challenge as they are less amenable for treatment. As high grade tumours they have short survival time, and prognosis depends not only on tumour type but also on site of the tumour .
The major milieu of brain tumours are derived from glial cells called gliomas. Highly malignant tumours are glioblastomas.In past decade in
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ABBREVIATIONS

SVZ	:	Sub ventricular zone
MPE	:	Myxopapillary ependymoma
GFAP	:	Glial Fibrillary Acidic Protein
WHO	:	World Health Organisation
IHC	:	Immunohistochemistry
ICMR	:	Indian Council of Medical Research
SEER	:	Surveillance, Epidemiology and End Result Program
CBTRUS	:	Central Brain Tumour Registry of the United States
CNS	:	Central Nervous System
PA	:	Pilocytic Astrocytoma
DFA	:	Diffuse Fibrillary Astrocytoma
DA	:	Diffuse Astrocytoma
ODG	:	Oligodendroglioma
EPEN	:	Ependymoma
PXA	:	Pleomorphic Xanthoastrocytoma
OA	:	Oligoastrocytoma
AA	:	Anaplastic Astrocytoma
GBM	:	Glioblastoma Multiforme
IDEM	:	Intradural Extramedullary
IDIM	:	Intradural Intramedullary
ED SOL	:	Extradural Space Occupying Lesion

CONTENTS

ABSTRACT

INTRODUCTION

Glial tumors are a varied group of neoplasm**.** CD117 is a protooncogene encoded tyrosine kinase receptor. It is expressed usually in some normal tissues and in neoplasms like GIST.(gastrointestinal stromal tumors) . Treatment with inhibitors of receptor for tyrosine kinase namely imatinib is proved successful in cases like gastrointestinal stromal tumour which are CD117- positive. Likewise aim of this study is to evaluate the expression of CD117 in tumors of glial origin,to prove the marker as useful marker for diagnostic purpose and also therapeutic purpose.This study also includes analysis of CD117 expression in glial tumor subtypes and grades.

AIMS AND OBJECTIVES

To study the expression of CD117 In glial tumors , to correlate the percentage of expression of cd117 with tumor type and grade, to evaluate CD117 as a diagnostic and therapeutic tool and also to study the age, sex, and site predeliction of different types of gliomas.

MATERIALS AND METHODS

This is a retrospective study,during the period from jan 2013-dec2014 .A total of 263 gliomas samples were received.out of these cases 50 representative cases were selected.Corresponding paraffin blocks were subjected to H&E staining and immunohistochemical analysis by primary marker CD117 .The results were tabulated in a master chart ,also recorded with photographs and were statistically analysed.

RESULTS:

CD117 was positive in 54% of total cases. CD117 expression was seen maximum in High grade tumours(66.8%) with statistical significance of (P <0.05). Highest CD117 expression score was seen in WHO grade III tumours with statistically significance (P=0.011*).The cells with marked nuclear pleomorphism showed increased CD117 expression,with statistical significance(P< 0.042). CD117 expression was high in cases with high cellularity showing statistically significance.(P < 0.041). Highest CD117 positivity was seen in 61-80 years age ,in females more than males,and in left hemisphere than right.

CONCLUSION

Incidence of gliomas are on the rise.CNS tumours are different from other tumours as treatment and prognosis depends on the site of the tumour and most tumours are less amenable for surgery. Our study shows CD117 is expressed remarkably in high grade tumours than low grade. Hence CD117 can be used as a perfect tool to identify these tumours and thus make them amenable to chemo therapy with tyrosine kinase inhibitor, like Imatinib., which is already proven and in vogue in gastrointestinal stromal tumour.Hence this study opens the vision on targeted therapy in gliomas for high grade tumours.

KEY WORDS : CD117,gliomas,high grade tumours, GIST, imatinib.

INTRODUCTION

Tumours of central nervous system pose a major challenge as they are less amenable for treatment. As high grade tumours they have short survival time, and prognosis depends not only on tumour type but also on site of the tumour .

The major milieu of brain tumours are derived from glial cells called gliomas. Highly malignant tumours are glioblastomas. In past decade in elderly people incidence of glioblastoma has increased spuriously due to advances in neuroimaging as even, the smaller lesions are picked out which were missed in earlier days. Hence according to Kurland and Schonberg[(1)] there is an ultimate necessity for a descriptive data on primary brain tumours. hence this study is designed to get a descriptive data.

Nervous system neoplasms affects both adults and children. The effects of these tumours were devastating even though they constitute a small percentage of all cancers. [(2)] Tumours of the CNS account for less than 2% of all malignancies (About 175,000 cases per year worldwide) [(3)] .The incidence does not vary markedly between regions or populations (Stewart and Kleihues, 2003).

Glial tumours are a varied group of neoplasms**.** CD117 is a protooncogene encoded tyrosine kinase receptor. . It is expressed usually in some normal tissues and. It is also expressed in neoplasms like GIST. (gastrointestinal stromal tumours). Treatment with inhibitors of receptor for tyrosine kinase namely imatinib is proved successful in cases like gastrointestinal stromal tumour which are CD117- positive Likewise aim of this study is to study the expression of CD117 in tumours of glial origin, to prove the marker as useful tool for diagnostic purpose and treatment. This study also includes analysis of CD117 expression in glial tumor subtypes and grades.

AIMS

AND

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AIMS AND OBJECTIVES

1) To study the expression of CD117 in Glial tumours
2) To correlate the percentage of expression of CD 117 with tumor type and grade.
3) To study the CD117 expression in tumours of glial origin as a useful tool for diagnostic and therapeutic purpose.
4) To study the age, sex, and site predeliction of different types of gliomas.

REVIEW

OF

LITERATURE

REVIEW OF LITERATURE

The central nervous system consists of, neurons, glial cells, meningothelial cells and endothelial cells of the blood vessels. Neurons form major part of the cells. The glial cells form supporting cells. They are divided into macro and microglia. Macroglia are composed of astrocytes, oligodendrocytes, and ependymal cells, derived from neurectoderm. microglia are derived from bone marrow and they are the phagocytic system of the CNS.

Astrocyte is the glial cell found throughout the CNS. They are called so because of their star shaped appearance, caused by multipolar branching cytoplasmic processes which have cytoplasmic intermediate filaments, named as glial fibrillary acidic protein. They are the main cells responsible for repair and scar formation in brain.

Oligodendrocytes are responsible for myelination in central nervous system. Ependymal cells are cuboidal cells lining the ventricles of cerebrovascular system Microglia are phagocytic system of the CNS derived from mesoderm. They are the fixed macrophage system respond to injury by proliferation, producing rod cells and nodules of microglia.

Neoplasms of the CNS was first described by Gupta longati a scientist from Russia in the year 1873 .They account for 2% of all cancers world wide. Annual incidence of CNS neoplasms ranges from 10-17/100,000 people for intracranial tumours and 1 to 2 /100000 people for intraspinal tumours. In children 70% of tumours occurs in posterior fossa and in adults most common in the cerebral hemisphere above the tentorium[4-9]. CNS tumours are divided into four broad categories namely

(1) gliomas

(2) neuronal neoplasms

(3) neoplasms which are poorly differentiated,

(4) and the last category meningiomas..

Gliomas are derived from glial cells and are composed of astrocytomas, oligodendrogliomas, and ependymomas. Gliomas are classified histologically by WHO [10]. But recent advances in brain tumor research are complemented with a list of biomarkers for molecular histopathology, Focus is also increasing on drugs against targeted therapy of tumour cell population.

Glial cells are derived from adult neural stem cells and glial progenitor cells. They have been proven to share some traits with gliomas as proposed by Sanai, Alvarez-Buylla etal. 2005[11)].

Human gliomas and glioma derived tumourspheres express stem cell related genes.[12].

Neural stem cells show high resistance for senescence and apoptosis, so they need lesser mutation for transforming into malignant when compared to well differentiated counterpart which require approximately four to seven mutation as postulated by (Renan1993; Sanai, Alvarez-Buylla et al. 2005)[11,13].

Adult human SVZ has proliferating adult neural stem cells[14] The biggest germinal areas of adult brain is the sub ventricular zone of lateral wall of left ventricle,[11,14,15,16] .MRI shows a group of glioblastomas that are associated with SVZ ,which arise as typically multifocal lesions and recur at sites significantly remote to primary tumour[17] .Interestingly showing that some gliomas originate in a mutated stem cell which give rise to transformed progenitor cell that can go away from the germinal area and multiply vigorously once they reach an amicable microenvironment.

EPIDEMIOLOGY OF NERVOUS SYSTEM TUMOURS:

In an analysis made in nation wide registry 2005 in korea studied 5,692 patients WHO were diagnosed as primary brain neoplasms in 2005. It was seen that CNS tumours occurred in a F:M ratio of 1.43:1. It was found that meningiomas were the most common tumours (31.2) %.Of all the gliomas 30.7% was glioblastomas, and among the malignant tumours of CNS 19.3% were glioblastomas. The medulloblastoma and germ call tumours were the most common tumours below 19 years of age [(18)]. This study showed the epidemiology in korea.

CBTRUS-The Central Brain Tumor Registry of the United States analysed data from 1990–1994 consisting of all primary CNS tumours from 11 state cancer registries, 20,765 case data was analysed and showed in general that the cns tumours annual incidence was at 11.5 cases per 100,000 person-years

- in male patients the incidence was (12.1 per 100,000 person-years)
- in female the incidence was (11.0 per 100,000 person-years)[(19)]

This study was conducted by Surawicz et al .it had similar results as the study of arora et al in England, it also showed that whites are affected more than blacks. Brain cancer accounts for1.4% of all cancer deaths and 2.3% of all cancer related deaths [(20)]

Another study conducted by arora et al in 53326 primary brain tumours showed that overall incidence was 9.21 per 100000 person years [21]. and the peak age affected was 70 -79 years. This study also showed that malignant tumours were 5.64%, benign tumours were 60%.it also showed supratentorial tumours affected older age group and infratentorial affected younger age group.

Similar work by Porter et al also shows that incidence of CNS tumours in united states was 18.1/100,000 person years.[22]

In india CNS tumours account for less than 2% of all malignancies.

According to ICMR statistics from 1982-1983 to 2002-2003 was studied incidence in males: according to Chennai registry 2.53 to 4.14 according to Delhi registry. Incidence in females according to Bhopal registry was 1.46 to 2.66 according to Delhi registry[23].

In pediatric age CNS tumours account for 27% according to SEER programme and national cancer registry[24]

According to study of Linabery et al of pediatric CNS tumours from 1992-2004 incidence in children were found to be 158/1000,000 person years. It was higher incidence in boys 29.9 per 10000,000 person years than girls of

25.1 per 1000,000 person years [25], during the period of 1992-2004 and found that the incidence of CNS tumours in children was 158 per 1,000,000 person-years. It was more common in boys than in girls (29.9 per 1,000,000 person-years as opposed to 25.1 per 1,000,000 person-years)

According to jain et al study in India paediatric CNS tumours show 14.8% incidence of all tumours.

EPIDEMIOLOGY OF GLIOMAS

- **Diffuse astocytomas** accounts for 10- 15 % 0f all astrocytic brain tumours and has incidence of 1.4 new cases per million population an year.**[26]** It represents the largest group and most prevalent tumour in adult brain[27]. Over all population based survival times of diffuse astrocytoma is 5.6 years.[28]

- Pilocytic astroctoma are slow growing neoplasms constituting 5-6% Of gliomas[29] . Follows an incidence rate of 0.37 per 100 persons per year and also commonest glioma of paediatric age group .These gliomas most commonly occur in cerebellum accounting to 68%.[30]

- Pleomorphic xanthoastrocytoma relatively uncommon astrocytic tumour accounts for less than 1% of astroctytic tumours.the clinicopathological

features of this tumour was first described in 1979 and so far 200 cases are reported.[31]

- Anaplastic astrocytomas occur in 50-75% of recurrent tumours[32].It is usually present at the age of 45-51 years and male:female ratio of 1.31 to 1.6 :1[29,30]

- Most common brain tumour is glioblastoma multiforme constituting 12–15% of the brain tumours and about 60-75% of all the astrocytic tumours.[30,33]andfollows incidence rates of 2.96 per 100000 population per year.[29,30,33].Glioblastomas has preference for cerebral hemispheres in adults but in neonatal and pediatric age group brain stem is the most common site[34]

- Gliosarcoma is a sarcomatous phenotype of glioblastoma constitutes 2-8 % of all cases of glioblastomas.[35,36,37,38]

- Gliomatosis cerebri - usually occurs in between 40 and 50 years of age, but also seen in neonates. Both sexes are affected equally but at an early age in males when compared to females.[39] .

- Oligodendroglioma accounts for 2% - 4% of all primary CNS neoplasms.and 9.5% of adult gliomas .Age adjusted incidence rates are 0.27

to 0.37 /100000 person years[40,41]. It also constitutes 71 to 79 % of WHO gradeII neoplasmspeak incidence rate.occurs in 35-44 years.

- Anaplastic oligodendroglioma constitutes minority of oligodendroglioma and form less than 5% of new malignant gliomas.[42].They also consist of 1.2% of all primary brain tumours with an annual incidence rates of 0.07 to 0.18 per 100000 population have been reported[29,30]

- oligoastrocytoma comprise 35 % of all oligodendroglial neoplasms and 20% of WHO grade 2 tumours,with an incidence rate of 0.1/100000 person years [39,41,43],

- Ependymomas constitutes 5.8 % OF gliomas 2.1% 0f all primary CNS neoplasms, It comprises for 50–60% of spinal gliomas [44] i.n adults.frequency of progression to anaplastic ependymoma is less common than astrocytic neoplasms [45]

- subependymomas constitutes 8% of all ependymal tumou.rs [46,47].

- myxopapillary ependymoma COMPRISES 9–13% of all ependymomas[46,47] most commonly occurs in cauda equine region.with male preponderance .M: F ratio of 2’2:1.

CLINICAL FEATURES:

- The clinical presentation of CNS neoplasms present corresponding to site and nature. They are epilepsy, focal neurological deficits, symptoms and signs due to raised intracranial pressure like headache,vomiting, clouding of consciousness, coma, papilloedema, and hydrocephalus. Signs and symptoms of brain tumours are usually nonspecific like headache, nausea, vomiting paresthesia, seizure, paraplegia or hemiplegia. visual disturbance or increased intracranial pressure. Signs specific to site are behavioural changes in frontal lobe lesions. most common lesions causing seizures are oligodendroglioma, anaplastic oligodendroglioma and gliosarcoma. Neoplasms causing raised intracranial pressure are ependymoma, anaplastic ependymoma, oligodendroglioma and glioblastoma multiforme. Neoplasms that present with hydrocephalus are posterior fossa neoplasms, central neurocytoma, chordoid glioma of third ventricle, subependymal giant cell astrocytoma,hypothalamic pilocytic astrocytoma and pineal gland neoplasms.[30, 39,48,49,50]

RISK FACTORS AND ETIOLOGICAL AGENTS

1) Sex:

Gliomas are more common in men than women with M:F ratio of 60:40.

2) radiation:

There is a strong correlation with exposure to therapeutic **ionizing radiation** like treatment of tinea capitis with development of gliomas according to Bondy et al 1994 and hodges et al 1992[51,52,53]. Electromagnetic fields can produce mutation which favours tumorigenesis and causes brain tumours.This was studied by Gurney and vanwijnagaarden 1999.

Mobile phones: It was thought that there was link between **non ionizing radiation** of mobile phones and gliomas but various studies conducted showed no clear association.[54,55], Interphone international case control study in 13 countries in 2765 gliomas and 2409 meningiomas showed no association between mobile phone usage and brain tuours

3) Low penetrance gene:

The popularly called GWAS - as genomic wide association studies has revealed many especially seven chromosomal regions , (TERT), telom erase reverse transcriptase, 1 (RTEL 1), in the regulator of telomerase longation helicase 1 (RTEL 1), cyclin dependent kinase inhibitor 2A and 2B (CDKN2A-CDKN2B), coiled-coil domain containing 26 (CCDC26), EGFR genes, TP53 and PHLDB1 gene (pleckstrin homology-like domain family B member 1) , is associated with a increased risk of glioma [56,57,58]

4). Genetic s syndromes:

In Literature as per study of Bondy et al , it is observed that there is strong association of gliomas in families having mentally retarded child. Also seen in first degree relatives and clustering of cases seen in some families.it showed association with hereditary syndromes like neurofibromatosis NF1,NF2,tuberous sclerosis TSC1,TSC2, LiFraumeni syndrome, turcot syndrome [59-63]. In 2007 an international study called Gliogene has started analysing susceptibility loci in families with more than two gliomas.It is an international study, started in 2007 to workup on the susceptibility loci in the families with more than two glioma.[63]

5) Viruses and glioma

In literature viruses have seen to be associated with carcinogenesis For example HPV is associated with cervical cancer. EBV is known to cause burkitts lymphoma, nasopharyngeal carcinoma and Hodgkin lymphoma likewise gliomas have been associated with sv 40 –simian 40 virus, cytomegalovirus, john Cunningham virus and adenovirus[64-70]

6) Occupational hazards

Literature shows increased incidence of brain cancer among farmers in vineyards exposed to pesticides. Studies reveal strong association. There was also increased incidence of gliomas in workers of petrochemical industries, fire fighting and embalmers but definitive etiological agents are under study.

The by products in rubber industry, n-nitroso compound also found in nitrate containing preservative have found to have association with gliomas is under study.[71]

ROLE OF NEUROIMAGING IN GLIOMAS

MRI, CT SCAN are primary modalities of investigation in brain tumour, in which CT is very useful when skull bone is involved.

MRI holds good when soft tissue is involved. In case of gliomas brain tissue with white matter looks expanded. Imaging also gives information on site, edema, dural attachment , enhancing lesions indicate vascularity and subsequent neoplastic nature.

Other recent techniques are

PET, positron emission tomography,

MRS-Magnetic resonance spectrophotometry.

FLAIR-fluid attenuation inversion recovery scan.in MRI is done.

SPECT-single photon emission computerised tomography scan and angiogram

INTRAOPERATIVE ANALYSIS OF SURGICAL SPECIMENS AND TYPES.

A methodological approach to the diagnosis is important in pathology, Hence intraoperative examination plays an important role in neuropathology. The surgeon needs information whether the lesion is non neoplastic, benign or malignant and the grade of the tumour for malignant lesions .This information helps them to plan on the extent of resection.

The types of intra operative consultation are

1) frozen section,
2) csf cell cytology
3) crush or squash preparation
4) imprint cytology,
5) open biopsy
6) stereotactic needle biopsy
7) secondary biopsy and
8) last resection specimens.

MACROSCOPIC SPECIMEN INTERPRETATION AND PROCESSING:

The specimen should be resected in such a way that, arachnoid, gray matter and white matter are seen. In order to get such a specimen it should be sectioned perpendicular to the meninges. On gross examination tumorous lesions are seen as solid areas which cannot be differentiated as either gray or white matter. They are usually admixed with haemorrhage and necroses. Cyst with a mural nodule is seen in pilocytic astrocytoma and some other astrocytomas .Gelatinous and cystic areas are seen in oligodendroglioma.

GLIOMAS –AN OVERVIEW

Gliomas in general are infiltrating neoplasms, less amenable for complete surgical resection. WHO classifies them according to cellularity, mitoses, pleomorphism, necroses and endothelial proliferation.

WHO grading of gliomas are

GRADE I - Pilocytic astrocytoma

Desmoplastic astrocytoma

Myxopapaillary ependymoma

GRADE II - Diffuse infiltrating astrocytoma ,

a) fibrillary astrocytoma

b) Gemistocytic astrocytoma

c)protoplasmic

Mixed gliomas

Pleomorphic xanthoastrocytoma

Oligodendroglioma

Ependymoma

GRADE III - Anaplastic astrocytoma

Anaplastic ependymoma

Anaplastic oligodendroglioma

Anaplastic oligoastrocytoma

GRADE IV - Glioblastoma multiforme

Giant cell glioblastoma

Gliosarcoma

Pilocytic astrocytomas (WHO grade I) :

It is a different type of astrocytoma which lacks infiltration into surrounding tissues ,hence carry better outcome than other gliomas. It affects children, adolescence and sometimes early adulthood. The tumour has predilection for cerebellum, hypothalamus, anterior optic pathway and third ventricle.in cases of NF1 it is seen in basal ganglia, thalami, cerebral hemispheres or spinal cord. Bilaterality is seen in optic nerve gliomas and

cerebellar astrocytomas. MRI T1 and T2 images shows microcystic areas within solid components. Microscopically it is a tumour exhibiting biphasic pattern. architecturally and cytologically areas of microcystic and fascicular pattern are seen. Fascicular pattern is seen as bipolar cytoplasmic processes which are delicate the cells appear spindle or oval embedded in a fibrillary matrix. The other pattern of microcystic areas appears as neoplastic cells suspended in pools of myxoid basophilic material. Also seen are Rosenthal fibres and eosinophilic granular bodies.

DESMOPLASTIC INFANTILE ASTROCYTOMA

It is nothing but tumours having histomorphology similar desmoplastic infantile glioma but with astrocytic differentiation. With slight female preponderance.(M:F =0.8:1)**(72)**.This tumour invariably occurs in infancy.it is a special variant consisting the family of neuronal –glial neoplasms .The age group of the tumour occurs inbetween 2 to 24 months. They are supratentorial occupying commonly, frontoparietal, combination of sites also seen.(73)**.** CT shows hyperdense lesion with contrast enhancement. The diagnostic histopathological feature is abundant desmoplasia seen as deposition of dense stroma in along with fibroblasts and primitive neuroepithelial components. These tumours have a favourable prognosis revealing that the primitive elements are not anaplastic.(73).

Pleomorphic xanthoastrocytoma (WHO grade II)

This tumour comes under family of desmoplastic neoplasms and it affects late childhood and young adults. It is seen to affect temporal lobes. It usually presents with epilepsy.Neuroimaging studies show cystic well demarcated contrast enhancing mural nodule. Grossly it occupies leptomeninges and subarachnoid space with invasion into brain parenchyma. Microscopically the cells exhibit marked pleomorphism, the cytoplasm has a ground glass appearance and filled withlipid vacuoles. Also seen are pericellular reticulin The cells are seen admixed with spindle-shaped cells in fascicular array, a few tumor giant cells and lymphoid infiltrates. Eosinophilic granular bodies which are lysosomes containing autophagic debris may be seen. It exhibits a favourable prognosis.

Diffusely infiltrating astrocytomas

They forms the largest group of astrocytic tumours and is the most prevalent brain tumours of the adults. These are unique in having an inherent tendency for biologic progression due to stepwise accumulation of specific genetic abnormalities[(21)]. The diffusely infiltrating astrocytomas is subclassified according to cytology of the tumour cells as – **fibrillary**, **gemistocytic**, and **protoplasmic**, of which diffuse fibrillary astrocytoma is the commonest. They are predominantly supratentorial lesions affecting frontal and temporal cerebral lobes but can be located anywhere in the CNS. The spinalcord and brain stem are the other frequently affected sites, while cerebellum is least likely to be

involved. A peak incidence occurs between 30 and 40 years of age. The main feature of this tumour is its feature of transforming into anaplastic. If the cytological component of DFA is composed of cells with plump cell body, abundant eosinophilic cytoplasm, nucleus displaced by the cytoplasm ,named as gemistocytes comprises 20% cells then the tumour is called gemistocytic astrocytoma.

Diffuse fibrillary astrocytomas (WHO grade II) :

The above group are the common primary neoplasms of the human CNS[(26)]familial syndromes associated cases are seen in type 1 neurofibromatosis, Li–Fraumeni (germline *TP53* gene mutation) syndrome, hereditary nonpolyposis colorectal carcinoma type 1 Turcot syndrome and multiple enchondromatosis syndromes known as Ollier or Maffucci disease**.[(26)]** Neuroimaging shows areas of hypodensity that are non-enhancing by contrast media which is employed to define foci of blood–brain barrier disruption. Presence of enhancement indicates anaplastic transformation. Gross appearance varies from barely visible lesions to large, gelatinous, soft, ill-defined gray-white areas that cause blurring of the gray-white interface expanding white matter and the cortex .Histologically these are hypercellular as compared to normal brain, ill-defined infiltrative, lesions centered in the white matter or rarely in the cerebral cortex. Neoplastic astrocytes are slightly enlarged, pleomorphic and has angular hyperchromatic cigar-shaped nucleus. Cytoplasm is scanty with asymmetrical cell processes .The cell are seen in matrix showing

loose fibrillary glia.

Gemistocytic astrocytoma (WHO grade II) :

These are tumours composed of > 20% of large plump tumor cells with globose glassy eosinophilic cytoplasm and eccentric nucleus called the gemistocytes.

Protoplasmic astrocytomas (WHO grade II) :

They affect cerebral cortex of children and young adults. They are superficially located tumours. ‘protoplasmic’ astrocytes principally reside in gray matter, rather than white matter . Histology reveals cytologically uniform cells with moderate eosinophilic cytoplasm. The cells are evenly dispersed in a matrix of short cytoplasmic fibrils (cobweb-like), myxoid material and microcysts. Nuclei are monomorphous, round or slightly oval, with minimal mitotic activity.

Anaplastic astrocytoma (WHO grade III) :

Anaplastic astrocytoma is seen in adults (mean age of 45 years), in children pontine lesions have been reported. On neuroimaging a hypodense lesion with contrast enhancement should raise suspicion of anaplastic astrocytoma. They have a higher cellularity with pleomorphic and hyperchromatic nucleus. The other nuclear alterations includes angulation, dense hyperchromasia, and considerable variation in contour and dimension.

Mitotic figures are readily seen as compared to low grade lesion.

Glioblastoma (WHO grade IV) :

There are two types according to etiology of glioblastoma namely **'**Primary' and 'secondary' variants are recognized. Secondary glioblastomas affects younger individuals as compared to the primary variants.Mean ages of secondary GBM is approximately 40 years, and that of primary GBM is 55 years. On neuroimaging shows a typical ring-enhancement is seen also showing abnormal vascularization, its also has a tendency to undergo spontaneous necrosis in the centre . Gross inspection shows a relatively circumscribed,clearly demarcated lesion with hemorrhagic discoloration and focal yellow softening caused due to coagulative necrosis which gives the variegated appearance. Histologically, glioblastoma is charecterised by extreme variation in cell cytology so named as glioblastoma 'multiforme'. Foci of differentiated elements may be seen with multinucleated bizarre tumor giant cells. The tumour cells can be spindle, rhabdoid, epithelioid, signet ring or rarely small cell. The last often dominates the histologic picture in case of recurrence, in such case the term small cell glioblastomas is used. The other known variants of GBM are giant cell glioblastoma, 'glioblastoma with oligodendroglioma component' 'glioblastomas with primitive-neuroectodermal tumor-like components'.

GLIOSARCOMA

It is a combination of gliomatous areas with sarcomatous region in varying proportions. The gliomatous area is astrocytic in nature with anaplasia. sometimes focal carcinomatous areas[74] J38 with gland formations or squamous metaplasia[75,76] can be seen in the glial portions. The sarcomatous component often shows typical fibrosarcoma like areas, occasionally resembles malignant fibrous histiocytoma[77,78]. A subset of cases may show other mesenchymal differentiation like areas of bone, cartilage, smooth and striated muscle ,osteoid-chondral tissue rarely lipoma like area.[79-,82]

Oligodendrogliomas

It is a another set of tumours included in gliomas. It includes classic and anaplastic type.

Oligodendroglioma, WHO grade II:

It affects young and middle-aged adults involving the cerebral hemispheres (the temporal and frontal lobes). It is the well-differentiated mor that exhibits little mitotic activity and is devoid of proliferative microvascular alterations or necrosis. Nodular foci of increased cellularity alone are compatible with this diagnosis Neuroradiologic study shows partial calcification diagnostic of oligodendroglioma. **Oligodendrogliomas** primarily involves the white matter with infiltration into the overlying cortex. It is composed of soft, gelatinous, gray–pink tissue, with cystic change also

contains a foci of dense calcification the cells are uniform, nuclei are round and an artefactual dissolution of cytoplasm accounts for the fried egg appearance.

These cells are seen in sheet-like arrangements. Scattered calcospherites, may be seen along the advancing edge of the tumor, and with ‘chicken wire’ like thin-walled blood vessels, also seen are 'satellitosis’- which is explained as perineuronal tumor cell aggregation can be seen

Anaplastic oligodendroglioma, (WHO grade III)

It may evolve in an already - existing oligodendroglial neoplasm of low-grade character or develop de novo. Dense cellularity, nuclear atypia, microvascular proliferation, endothelial hypertrophy and increased mitotic activity – with necrosis is characteristic of these tumours.. Tumour has avery bad prognosis

Ependymal tumours

The gliomas include tumours from ependymal cells, called ependymoma, which in turn possesses unique characteristics.

Ependymomas

Ependymomas has age with site predeliction, intracranial lesions are seen in childhood and itramedullary lesions are seen in adults.it also comprises 6-9% of primary CNS neoplasms. In the fourth decade 66 % is seen

in the fourth ventricle, and hence it causes obstructive hydrocephalus.in MRI they are contrast enhancing lesions that are well circumscribed. These lesions are found arising from floor of the fourth ventricle.

Ependymomas originating in spinal cord commonly arises from the cervicothoracic segments. except myxopapillary type. They constitute the position of being the commonest of all neoplasms in adult[83,84].In cases of ependymomas seen in cases of neurofibromatoses -2 (NF-2), characteristic features are multifocality and intramedullary location[83]. They have also seen to arise from cranial nerves[85], retina[86], and the sella turcica[87] .

Microscopically, the perivascular pseudorosettes are seen as dense meshwork of fibrillary cytoplasmic process of ependymal cells which condense around blood vessels. True rosettes are tubules resembling normal ependymocytes can be seen cells have nuclei which are spindly having uniform granular chromatin without nucleoli. Some cells show cytoplasmic pseudoinclusions[88]. Also lesions which have dense celluarity, narrow pseudorosettes and occasional mitosis are called **cellular ependymoma**. Dystrophic calcification is sometimes present. Literature also describes variants like giant cell xanthomatous and melanotic ependymomas.

Tanycytic ependymomas are a variant of ependymomas in which. tanyos is a greek word meaning to stretch.as the name implies these are

tumours which have fascicular growth pattern and also seen are,spindly cytology admixed with illformed pseudorosettes predominantly seen in spinal levels .[89] .

Clear cell ependymomas[90 91] are seen especially in supratentorium showing clear cell morphology with calcospherules along with rich vascularity. Also seen are brisk mitotic activity. The cells show nuclear features of high grade.

Another variety of ependymomas have papillary processes lined by neoplastic columnar epithelial cells and is so called **papillary ependymomas**

Anaplastic ependymoma - grade III WHO

These are a group of poorly differentiated tumours having dense cellularity, brisk mitotic activity necrosis, and also seen are pseudopalisading and rich microvascular proliferation). As the name suggest they are highly aggressive tumours with short survival.

Myxopapillary ependymoma grade I WHO

It is seen most commonly in the conus medullaris[92]. They are mostly seen as extradural ependymomas in the region of sacrococcyx in the subcutaneous tissues[93,94] or, sometimes extremely rare in the sacrum. rarely [95] The common age group of these tumours are third to fifth decades of ones,

life. Neuroimaging studies usually shows a contrast-enhancing sharply well circumscribed mass. Microscopically the tumour cells seem to be cuboidal and are also seen are mucinous basophilic material which are seen to surround blood vessels.

Subependymoma grade I –WHO

It mainly affects adults and common site involved are the fourth ventricles, lateral ventricle, cerebral aqueduct. It can also be seen in third ventricle, or spinal cord [96,97,98].

Subependymomas are seen to be well lobulated and delimited lesions. While Small ones are solid lesions larger lesion are cystic. Calcification is seen most commonly. Histo pathology shows three features they are tumor cells arranged in multinodular pattern seen in aggregates, dispersed in a voluminous fibrillary matrix in a disorganized manner, also seen are compact or microcystic areas. Tumor cell nuclei are oval in shape consisting of punctate chromatin.

Mixed gliomas

These are infiltrative lesions affecting the cerebral hemispheres of adults especially the frontal and temporal lobes and are termed as **oligoastrocytomas** comes under WHO grade II and **anaplastic oligoastrocytomas** comes under WHO grade III. Anaplastic astrocytoma has

higher cellularity, nuclear atypia, readily apparent mitotic activity and complex microvascular hyperplasia rarely.

Prognostic factors in Glial tumours:

1) The age of the patient[99]
2) Karnofsky Performance Status at the time of diagnosis[100] ,
3) Extent of surgery[101]
4) Macroscopically radical resection [102],
5) Another prognostic factor is a histological grade and type are known to affect prognosis.

Glioblastoma patients with promoter region methylation of *MGMT* gene are treated with Temozolomide[103,104] and those treated with Bevacizumab[105] have an increased chance of prolonged disease free survival .

CYTOGENETICS:

It was initially thought glioblastoma arise in two different settings clinically one in elderly, called primary and another seen less commonly in younger age groups .as transformation of low grade tumours to high grade ones. Advances in molecular genetics (Data From Cancer Genome Atlas Network) have classified glioblastomas under four categories namely **classic type** showed PTEN mutation EGFR gene amplification and also, chromosome

10 deletion., also seen are focal deletions of chr 9p21. **mesenchymal type** seen are deletions of the NF1gene on chr 17, also highly expressed are NF-KB pathway genes, and TNF pathway genes. **Neural** type shows increased neuronal marker expression namely, NEFL, GABRA1, additional markers expressed are SYT1 and SLC12A5.

Proneural Type is most commonly seen in secondary glioblastomas is associated with TP53 mutation and point mutation of IDH1 and IDH 2 gene. They also show over expression of PDGFRA. Low grade gliomas have mutations in TP53 and also IDH genes.R tumours.

- Cytogenetic studies in pilocytic astrocytomas show normal karyotype in majority of cases.[106,107,108], but studies show have postulated some balanced translocations [108].or minute copy number changes.
- Pleomorphic xanthoastrocytoma also discovered to have gain of chromosomes 7 and 3 frequently.[109,110,111]. Most of them are diploid. [112,113].
- Low-gradeastrocytoma which possess TP53 mutation show very less time for progreession into diffuse astrocytoma [114, 115].
- TP 53 mutations are also seen in higher frequency in anaplastic astrocytoma. [116, 117, 118,] . Other mutations seen are 35-60% of LOH 10q mutations,18 -23 % of PTEN mutations. [119,120,121, 122,]

- Gliosarcoma possess the following mutations [123,124,125,],

PTEN mutations	-	(38–45%)
p16INK4a deletions	-	(38%)
TP53 mutations	-	(23–24%),

Oligodendrogliomasis both classical and anaplastic variety seems to possse unbalanced translocation in chromosomes 1 and 19 [t(1;19) (q10;p10)], lesser expression is seen in anaplastic astrocytoma.[125]

Ependymomas, show aberrations involving chromosome 22 very often. {126} like deletions Monosomy or translocations .

ROLE OF IMMUNOHISTOCHEMISTRY IN NERVOUS SYSTEM TUMOURS:

The armamentarium of Diagnostic neuropathology has improved more in recent past due to immunohistochemistry techniques in addition to squash and histomorphology. New reagents are being developed against specific antigens associated with stages of cell lineage, oncogene, cell cycle and suppressor gene product or cell activation. Use of these antibodies will help us to define the nature of cellular maturation, tissue differentiation, tumour progression, and metastasis.

It is of great help in cases of metastases with unknown primary as the metastases express antibody of parent site Immunohistochemistry helps us not only to know about the cell of origin ,ability of the tissue to express a particular antigen but also its exact cellular localization. This method also employs antibodies to distinguish the antigenic differences between the cells. These antigens can identify cellular lineage,within particular cell lineage different subsets,and also some infections.

For immunohistochemistry, Peroxidase – antiperoxidase method, Avidin-biotin method are commonly used methods. The important step is selection of antibody particular that antigen.

The most important groups of antibodies are Intermediate filaments, Neuroendocrine related proteins, Markers with predominant expression in CNS tumour, Markers associated with suppressor genes, oncogenes and related gene products,. Markers to detect cell proliferation and cell death in CNS tumours

Immunohistochemical markers most widely used are;

1) Keratin - identifies epithelium
2) Vimentin – identifies Mesenchymal cells, Astrocytes,
3) Glial fibrillary acidic protein (GFAP) identifies. glial cells Astrocytes. Nonmyelinating Schwann cells, Ependymal cells

ROLE OF CD117 IN GLIAL TUMOURS

CD 117 is a proto-oncogene, a C KIT product, tyrosine kinase receptor, found to be located in chromosome 4 in its long arm. This receptor has many specialised unique biological functions. The expression of this receptor is seen in some tumours and also few normal cells. CD117 expression has found its place in immune histochemistry after the successful treatment of CD117 positive gastrointestinal stromal tumours being treated with tyrosine kinase inhibitors, namely Imatinib. Hence in this concept the evaluation of CD117 distribution and its functions, the evaluation of this receptor, its encoding gene in many tumours of central nervous system is very useful. As the fact is only that very little data is available on immunohistochemical expression of CD117 in glial tumours, this study is aimed at determining CD117 expression in these tumours in all grades and all histopathological types .It also correlates and compares the percentage of stained cells and intensity of staining in different pathological grades . It also analyses the uniqueness in immunoreactivity in various histopathological type and grades.

According to the study of Parvin et al[(127)]. However, the intensity of CD117 expression as well as the percentage of stained cells shows difference of considerable significance among low-grade tumours and high- grade gliomas, suggesting them as helpful parameters in making distinction between the low-grade and high-grade gliomas when determination of grade is not

straight forward. Study of parvin et al shows that high grade gliomas showing prominent expression of CD117 can be subjected to chemotherapy with tyrosine kinase inhibitors.

MATERIALS AND METHODS

MATERIALS AND METHODS

This is a retrospective descriptive clinicopathological analysis of gliomas in the Department of Neuropathology, Madras Medical College and Rajiv Gandhi Government General hospital, Chennai during the period of jan 2013 to dec 2014

Source of data:

Cases of gliomas reported in the Department of Neuropathology, Madras Medical College during the period of jan 2013 to dec 2014 from the Department of Neurosurgery, Rajiv Gandhi Government General hospital. A total 836 specimens where received during this study period, out of this 263 cases are gliomas.

Inclusion Criteria:

Patients diagnosed as glial tumours astrocytoma, oligod endro glioma, oligoastrocytoma, ependymoma, their subtypes and combinations. As per the WHO grading system, tumours of glial origin are grouped as either low or high grade. WHO Grade I and II are considered as low grade tumours and WHO grade III and IV are considered as tumours of high grade.

Exclusion criteria:

Nonneoplastic lesions of CNS, benign lesions of CNS, meningiomas, lymphoid neoplasms and all other neoplasms excluding gliomas.

METHOD OF DATA COLLECTION:

This is a retrospective study. Relevant clinical details regarding age, sex, symptoms, radiological findings including CT and MRI, per operative squash findings and gross findings were obtained for all the case of glioma from neuropathology registers from january 2013 to December 2014. and relevant investigations are collected from the medical records of Institute of pathology, Madras Medical College, Chennai between the period of 2013-2014. Out of these cases a total of 50 cases which were representative of the Whole sample was selected randomly with grade-I(9 cases), grade II(15 cases), grade III (7cases), grade IV (19 cases).

Corresponding paraffin blocks are collected and histopathological sections are prepared in a glass slide from formalin fixed paraffin embedded tissue of resected specimens. They are subjected to H&E staining and immunohistochemical analysis by primary marker CD117. This is done for a total of 50 selected cases. The results were tabulated in a master chart and also recorded with photographs. As far as possible follow up data regarding adjuvant therapy, recurrence disease free survival, for some patients were got from MRD –medical records section Follow up data of some of the patients regarding the adjuvant therapy, recurrence, disease free survival were obtained from Medical Records Section of Department of neurosurgery and oncology.

IMMUNOHISTOCHEMICAL EVALUATION:

Immuno Histochemistry is a molecular technique which was first described by Dr.Albert Coons in 1941. Immunohistochemical analysis using CD 117 were done in paraffin embedded tissue samples using poly Excel detection system protocol. Due to economic constraints, immunohistochemistry were done only for 50 cases. 4 micron thickness of paraffin embedded sections are taken and transferred to gelatin coated slides. Antigen retrieval is done using EDTA buffer, as antigen retrieval solution. And heat retrieval methodology is used for antigen retrieval.

Sections with a thickness of 4 μ from selected formalin fixed paraffin embedded tissue samples were transferred onto gelatin coated slides. Heat induced antigen retrieval was done. The antigen is bound with rabbit monoclonal antibody (Pathnsitu) CD117 receptor and then detected by the addition of secondary antibody conjugated with horse radish Peroxidase-polymer and Diaminobenzidine substrate.

ANTIBODIES IN IMMUNOHISTOCHEMISTRY

Antigen	**Vendor**	**Clone**	**Species**	**Dilution**	**Positivity**	**Positive control**
CD117-C-terminus	Pathn Situ	EP10	Rabbit – igG	1:50 To 1:100	Cytoplasm &membrane	Gastrointestinal stromal tumour

INTERPRETATION & SCORING SYSTEM:

The immunohistochemically stained slides were analyzed under the microscope for the presence of reaction which was detected by the brown colour of DAB chromogen and various parameters are analysed namely

1) Cellular localization - both cytoplasmic and membrane positivity
2) Among the neoplastic cells the percentage of cells stained. IHC stained cells was graded by a semiquantutative scale which ranges from

    score 0 - No immunoreactive cells

    score 1+ - 1-10%

    score 2+ - 11-50%

    score3+ - 51-75%

    score4+ - more than 75% [128]

3) The intensity of staining reaction was graded as Weak, moderate and strong.

STATISTICAL ANALYSIS:

The statistical analysis is performed using statistical package for social science software version IBM SPSS 20. For analysis for category variables we have used CHI SQUARE test

OBSERVATION

AND

RESULTS

OBSERVATION AND RESULTS

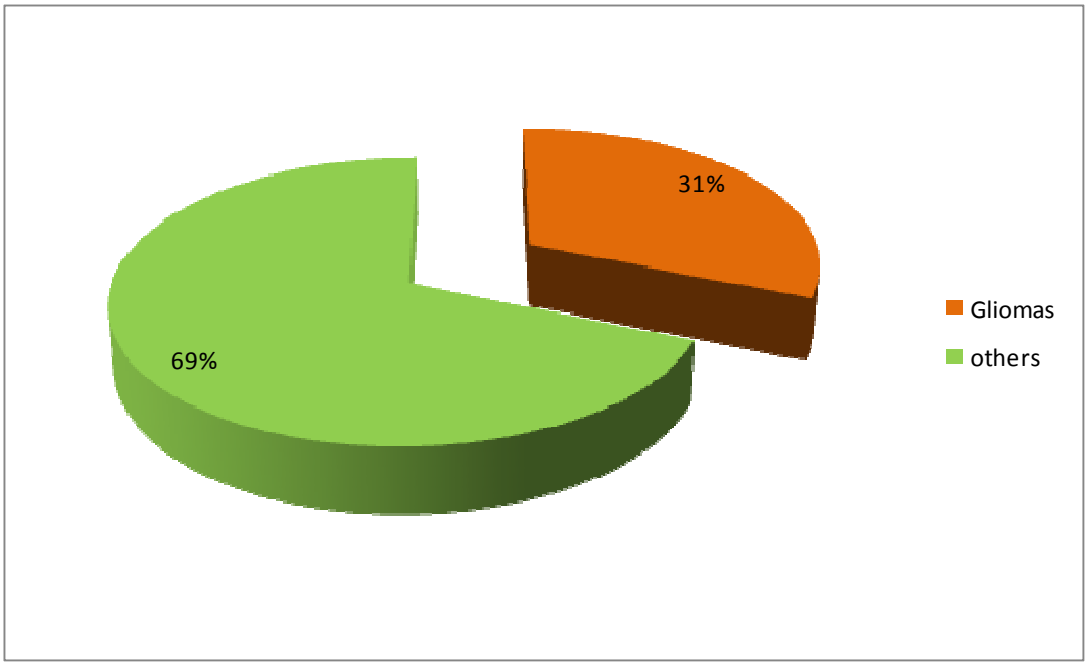
The total number of cases received in our institute of neuropathology were 836 cases over a period of 2 years, from jan 2013 to dec 2014. Out of which 274 were non neoplastic, 562 were neoplastic. Among the neoplastic cases, 263 cases were gliomas, 137 cases were meningiomas and rest 299 were other neoplasms like, tumour of sellar origin, neurectodermal tumours, germ cell neoplasms etc.

TABLE 1: Distribution of cases in neuropathology department

	No of cases	**Percentage**
Non neoplastic	274	32.8
Gliomas	263	31.4
Meningiomas	137	16.4
Other neoplasms	162	19.4
Total	836	100

Gliomas constitute maximum incidence of 31.4% among all cases.

CHART NO 1 : INCIDENCE OF GLIOMAS



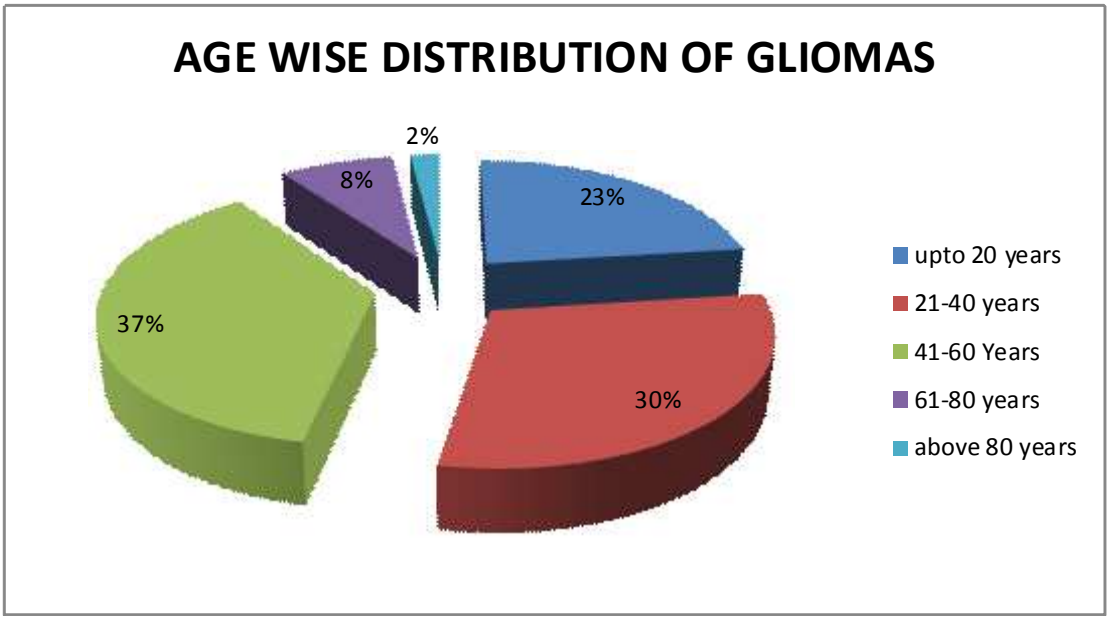
The age distribution of gliomas has been tabulated among the 263 cases. In this study, the minimum age in which glioma was observed was 6 months. The maximum age observed was 85 and it showed a mean age of 38 years with a standard deviation of 19.6.

DISTRIBUTION OF AGE IN THE STUDY					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
AGE	263	0.5years	85	37.9224	19.67214

TABLE NO 2 : AGE WISE DISTRIBUTION OF GLIOMAS

Age_group	No of cases	Percent
upto 20 years	60	22.8
21-40 years	79	30.0
41-60 Years	98	37.3
61-80 years	22	8.4
above 80 years	4	1.5
Total	263	100.0

CHART NO 2 : AGE WISE DISTRIBUTION OF GLIOMAS



The above table shows there is no specific increase in incidence of gliomas with increasing age.

The peak incidence of gliomas was seen in 41-60 years accounting to 98 cases(37.3 %) .

It also shows least incidence of gliomas in the age group more than 80 years accounting to 4 cases.(1.5%).

TABLE 3 DISTRIBUTION OF HISTOLOGICAL SUBTYPES OF GLIOMAS

	HISTOLOGICAL SUBTYPE	**NO OF CASES**	**Percentage**
1)	PILOCYTIC ASTROCYTOMA	38	14.4
2)	MYXOPAPILLARY EPENDYMOMA	2	.8
3)	DESMOPLASTIC ASTROCYTOMA	1	.4
4)	GEMISTOCYTIC ASTROCYTOMA	1	.4
5)	DIFFUSE FIBRILLARY	18	6.8
6)	DIFFUSE ASTROCYTOMA	20	7.6
7)	PLEOMORPHIC	3	1.1
8)	OLIGO ASTROCYTOMA	5	1.9
9)	OLIGODENDROGLIOMA	20	7.6
10)	GANGLIOGLIOMA	6	2.3
11)	EPENDYMOMA	24	9.1
12)	ANAPLASTIC ASTROCYTOMA	21	8.0
13)	ANAPLASTIC OLIGO	2	.8
14)	ANAPLASTIC	2	.8
15)	ANAPLASTIC EPENDYMOMA	6	2.3
16)	GLIOBLASTOMA MULTIFORME	94	35.7
	Total	263	100.0

From the above table it is inferred that out of the 263 gliomas studied in a two year period in our institute Glioblastoma multiforme was the most common one accounting for 94 cases (35.7%). Pilocytic astrocytoma was the second most common glioma accounting for 38 cases (14.4%).

Least common were pleomorphic xanthoastrocytoma (1.1%), oliogoastrocytoma (1.9%), anaplasticoliogoastrocytoma (0.8%), Anaplastic oligodendroglioma (0.8)%.

CHART NO 3 : DISTRIBUTION OF GLIOMA SUBTYPES

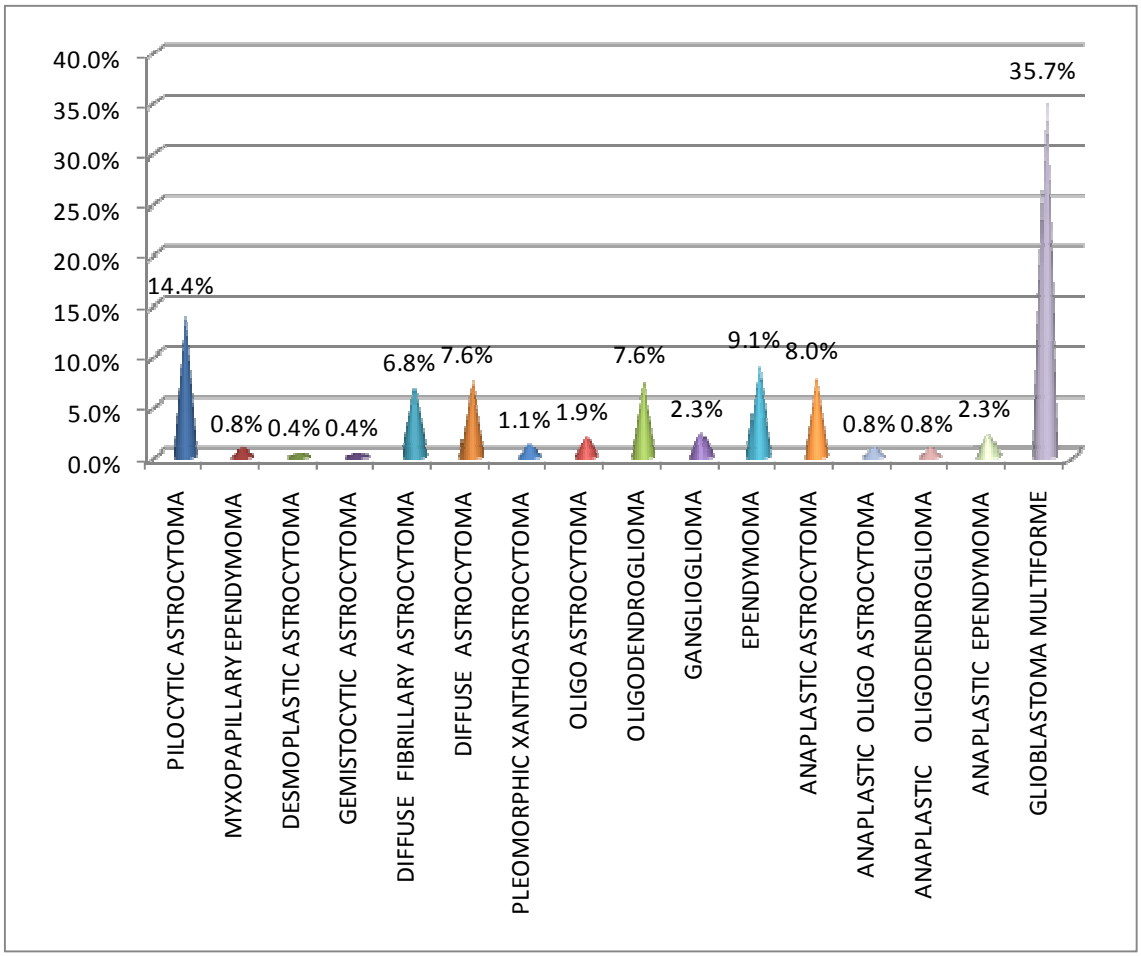


TABLE 4 : SEX DISTRIBUTION OF GLIOMAS

SEX	NO OF CASES	PERCENTAGE
Male	168	63.9
Female	95	36.1
Total	263	100.0

The above table shows that gliomas have a male preponderance. Out of the 263 cases studied 63.9 % (168) of cases have occurred in males and 36.1 % (95) of cases have occurred in females.

CHART 4 : SEX DISTRIBUTION OF GLIOMAS

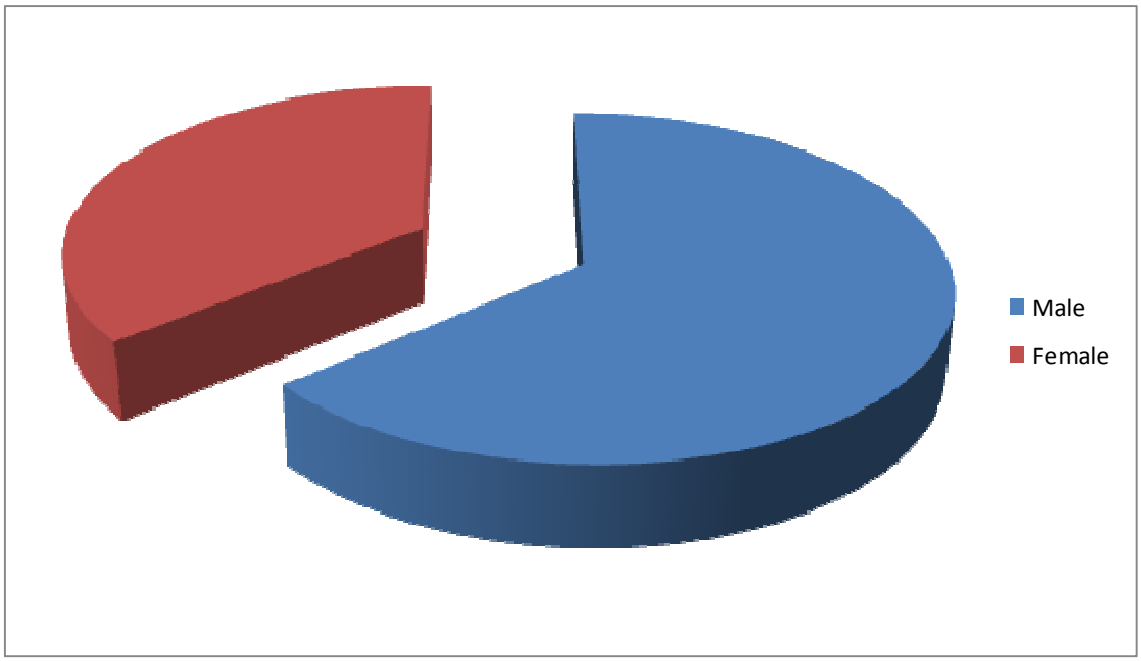


TABLE 5 : DISTRIBUTION OF SIDE INVOLVEMENT OF BRAIN IN GLIOMAS

SIDE	NO OF CASES	PERCENTAGE
LEFT	87	33.07%
RIGHT	118	44.8%
MIDLINE	58	22.05%
TOTAL	263	100%

In the above table right side of brain was most commonly involved 44.8%, left side 33.07%, and other midline deep structures 22.05%.

CHART NO 5 : DISTRIBUTION OF SIDE INVOLVEMENT OF BRAIN IN GLIOMAS

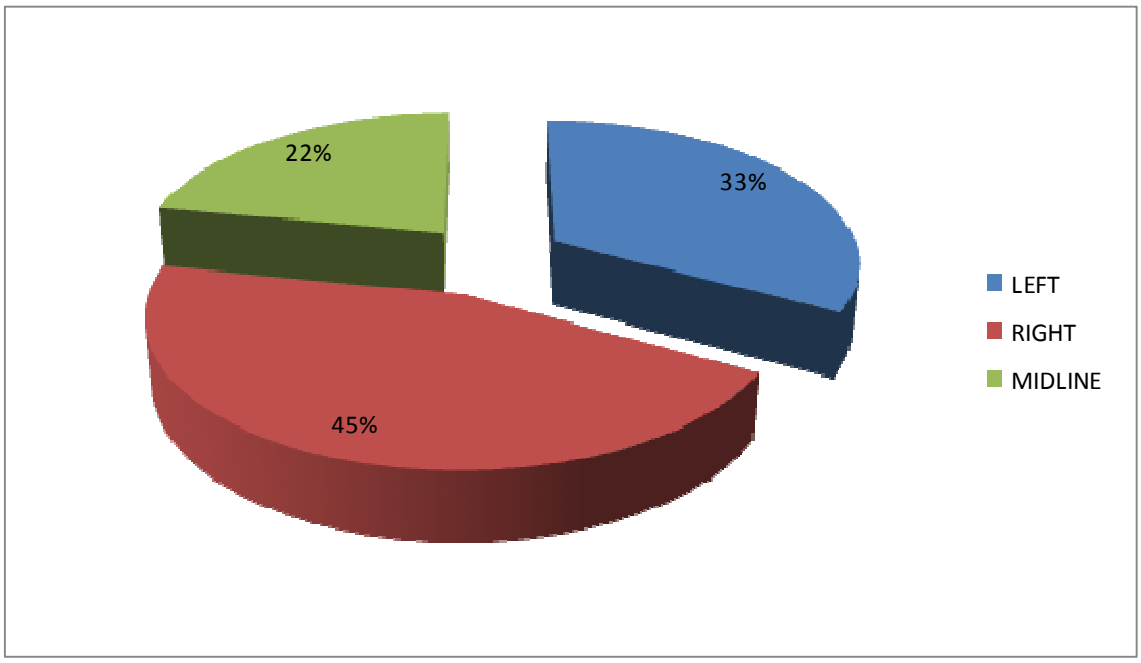


TABLE 6 : SITE WISE DISTRIBUTION OF GLIOMAS

	SITE	NO OF CASES	Percentage
1.	FRONTAL	52	19.8
2.	FRONTOPARIETAL	23	8.7
3.	FRONTO TEMPORAL	13	4.9
4.	TEMPORAL	30	11.4
5.	TEMPOROPARIETAL	34	12.9
6.	PARIETAL	17	6.5
7.	OCCIPITAL	12	4.6
8.	PARIETOFRONTAL	2	.8
9.	CEREBELLUM.	7	2.7
10.	CPANGLE.	2	.8
11.	BRAIN STEM,	5	1.9
12.	CORPUS CALLOSUM	7	2.7
13.	INTRAVENTRICULAR	14	5.3
14.	POSTERIOR FOSSA	19	7.2
15.	OPTIC NERVE	1	.4
16.	OPTIC CHIASMA	1	.4
17.	BASAL GANGLIA	7	2.7
18.	SUPRASELLAR	3	1.1
19.	ED SOL	1	.4
20.	ID IM SOL	10	3.8
21.	ID EM	3	1.1
	Total	263	100.0

The cerebral lobes are most commonly involved by glioma of which frontal lobe has the highest incidence accounting to 19.8 %(52 cases). The second most common is the temporoparietal region accounting to 12.9 % (34 cases). The occipital lobe showed the least common involvement accounting to 4.6% (12 cases).

In the spinal cord out of the 14 cases, intradural intramedullary lesions were most common accounting to 10 cases (3.8% 0f total cases), intradural extra medullary was second most common accounting to 3 cases (1.1% of total cases) and one case was extradural lesions accounted to 0.4% of total cases.

CHART NO 6 : SITE WISE DISTRIBUTION OF GLIOMAS

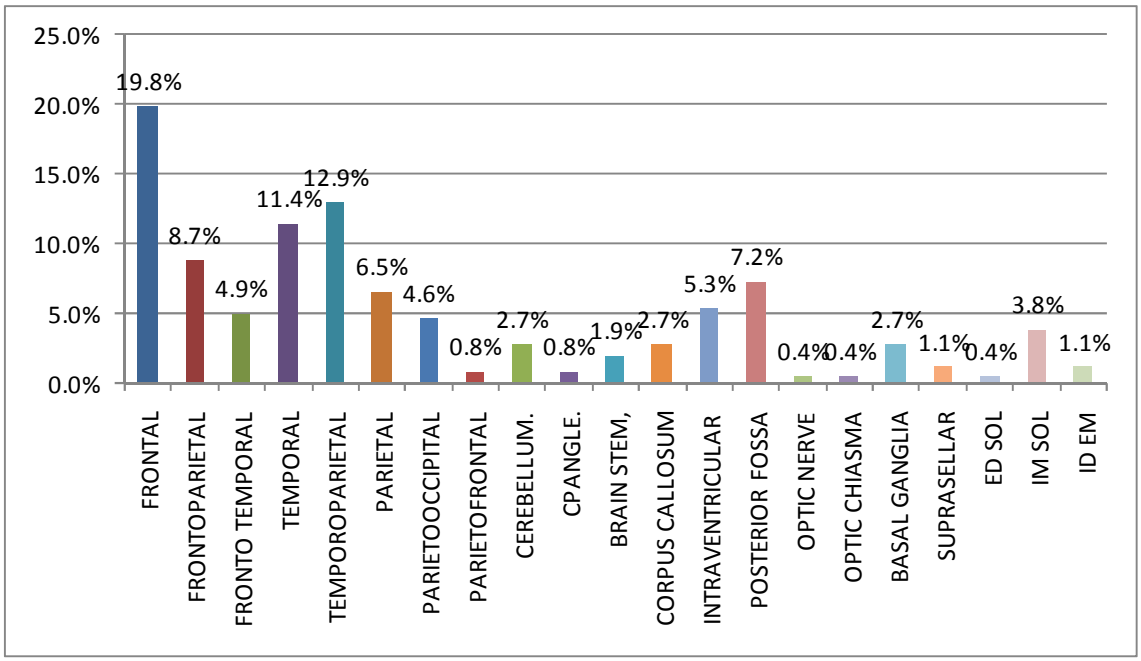
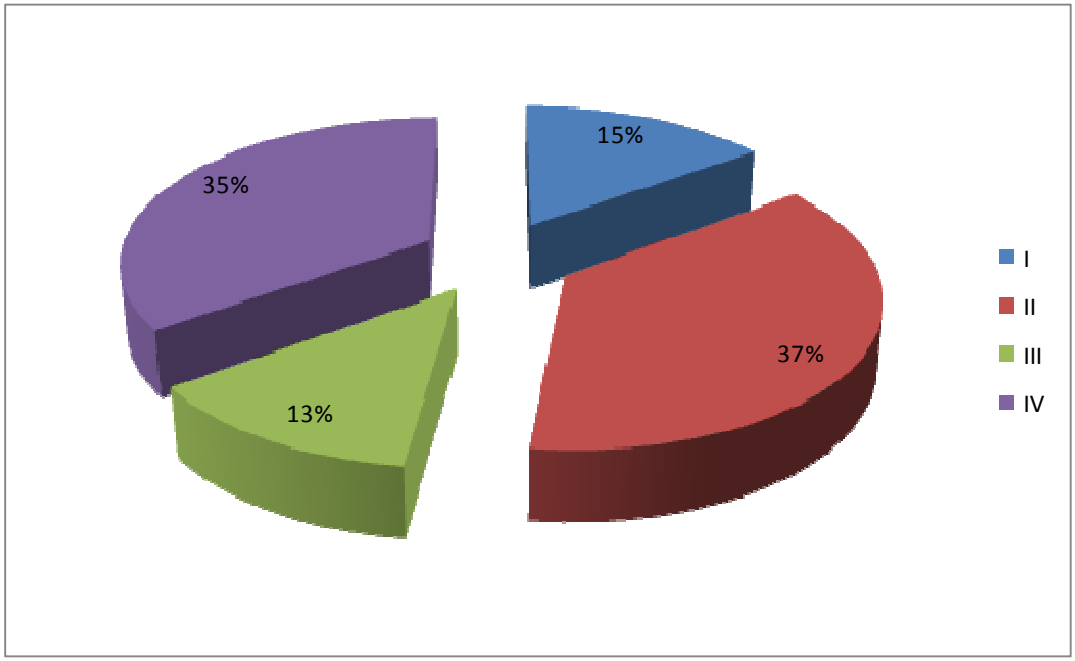


TABLE 7: DISTRIBUTION OF GLIOMAS- GRADEWISE

		No of cases	Percentage
WHO GRADE	I	40	15.2
	II	97	36.9
	III	33	12.5
	IV	93	35.4
	Total	263	100.0

CHART NO 7 : DISTRIBUTION OF GLIOMAS GRADEWISE



All the 263 cases of gliomas, were grouped according to WHO classification into four grades namely grade I - IV. WHO Grade I and II are grouped together as low grade and Grade III and IV are grouped under high grade in this study.

In the above table 40 cases belong to grade I, 97 cases belong to grade II, 33cases belong to grade III, and 93 cases belong to grade IV, constituting 15.2%, 36.9%, 12.5%, 35.4% respectively.

It was found that most common grade was WHO grade II tumours (36.9 %), followed WHO grade IV tumours (35.4%).

TABLE NO 8 : CORRELATION OF AGE AND GRADE OF GLIOMAS.

			WHO GRADE				Total
			I	II	III	IV	
Age Group	upto 20 years	Count	32	22	4	2	60
		%	53.3%	36.7%	6.7%	3.3%	100.0%
	21-40 years	Count	6	40	16	17	79
		%	7.6%	50.6%	20.3%	21.5%	100.0%
	41-60 Years	Count	2	30	10	56	98
		%	2.0%	30.6%	10.2%	57.1%	100.0%
	61-80 years	Count	0	5	2	15	22
		%	0.0%	22.7%	9.1%	68.2%	100.0%
	above 80 years	Count	0	0	1	3	4
		%	0.0%	0.0%	25.0%	75.0%	100.0%
Total		Count	40	97	33	93	263
		%	15.2%	36.9%	12.5%	35.4%	100.0%

P<0.001*

The above table is given to analyse if there is any particular age predilection for different grades of tumour.

WHO grade I tumour was most common in age group of less than 20 year, (53.3%). WHO grade II was most commonly seen in age group of 21-40 years (50.6 %). WHO grade IV tumours are commonly seen in the age group above 80 years (75%).

CHART NO 8 : CORRELATION OF AGE GROUP WITH GRADE OF GLIOMAS

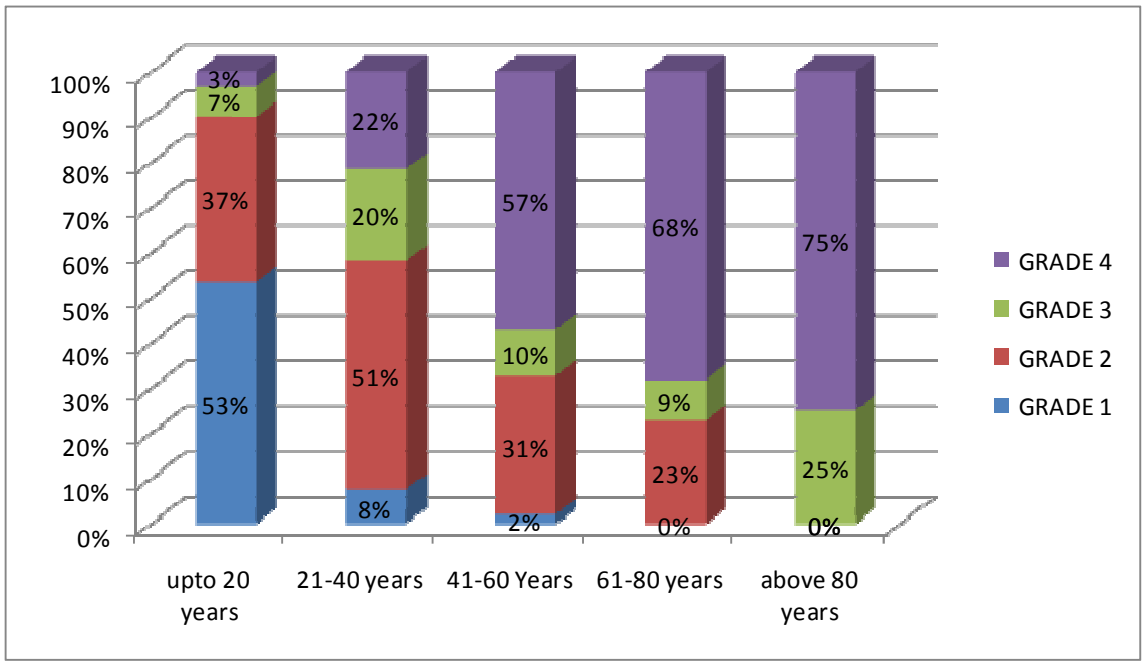


TABLE NO 9 : CORRELATION OF SUBTYPES OF GLIOMAS WITH AGE

This table shows various percentage of different types of tumours, in different age group. it also show in which age group the particular tumor predominantly affects.

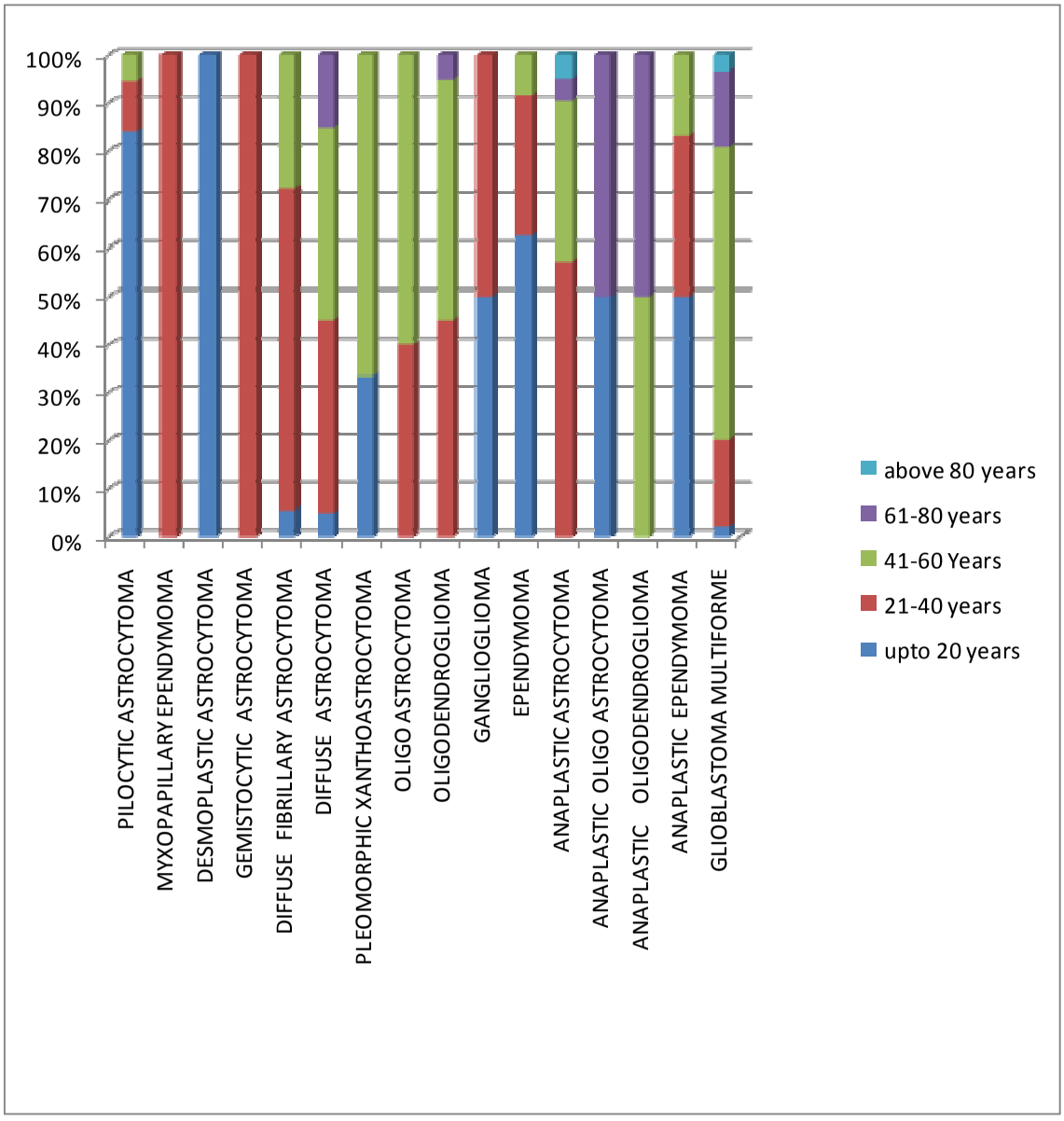
DIAGNOSIS * age_group correlation								
			age_group					Total
			upto 20 years	21-40 years	41-60 Years	61-80 years	above 80 years	
	PILOCYTIC ASTROCYTOMA	Count	32	4	2	0	0	38
		%	84.2%	10.5%	5.3%	0.0%	0.0%	100.0%
	MYXOPAPILLARY EPENDYMOMA	Count	0	2	0	0	0	2
		%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%
	DESMOPLASTIC ASTROCYTOMA	Count	1	0	0	0	0	1
		%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	GEMISTOCYTIC ASTROCYTOMA	Count	0	1	0	0	0	1
		%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%
	DIFFUSE FIBRILLARY ASTROCYTOMA	Count	1	12	5	0	0	18
		%	5.6%	66.7%	27.8%	0.0%	0.0%	100.0%
	DIFFUSE ASTROCYTOMA	Count	1	8	8	3	0	20
		%	5.0%	40.0%	40.0%	15.0%	0.0%	100.0%
	PLEOMORPHIC XANTHOASTROCYTOMA	Count	1	0	2	0	0	3
		%	33.3%	0.0%	66.7%	0.0%	0.0%	100.0%
	OLIGO ASTROCYTOMA	Count	0	2	3	0	0	5
		%	0.0%	40.0%	60.0%	0.0%	0.0%	100.0%
	OLIGODENDROGLIOMA	Count	0	9	10	1	0	20
		%	0.0%	45.0%	50.0%	5.0%	0.0%	100.0%

	GANGLIOGLIOMA	Count	3	3	0	0	0	6
		%	50.0%	50.0%	0.0%	0.0%	0.0%	100.0%
	EPENDYMOMA	Count	15	7	2	0	0	24
		%	62.5%	29.2%	8.3%	0.0%	0.0%	100.0%
	ANAPLASTIC ASTROCYTOMA	Count	0	12	7	1	1	21
		%	0.0%	57.1%	33.3%	4.8%	4.8%	100.0%
	ANAPLASTIC OLIGO ASTROCYTOMA	Count	1	0	0	1	0	2
		%	50.0%	0.0%	0.0%	50.0%	0.0%	100.0%
	ANAPLASTIC OLIGODENDROGLIOMA	Count	0	0	1	1	0	2
		%	0.0%	0.0%	50.0%	50.0%	0.0%	100.0%
	ANAPLASTIC EPENDYMOMA	Count	3	2	1	0	0	6
		%	50.0%	33.3%	16.7%	0.0%	0.0%	100.0%
	GLIOBLASTOMA MULTIFORME	Count	2	17	57	15	3	94
		%	2.1%	18.1%	60.6%	16.0%	3.2%	100.0%
Total		Count	60	79	98	22	4	263
		%	22.8%	30.0%	37.3%	8.4%	1.5%	100.0%

P<0.001*

CHART NO 9 : CORRELATION OF GLIOMA TYPES

VS AGE GROUP



The commonest age group of individual tumour has been inferred from the table. Pilocytic astrocytoma was found to commonly affect the age group of 0 to 20 years. Myxopapillary ependymoma was found commonly to affect the age group of 20- 40 years

Diffuse fibrillary astrocytoma was found commonly to affect the age group of 21-40 years.

In Diffuse astrocytoma, out of the 22 cases studied 8 cases occurred in 21-40 years and 8 cases occurred in 41-60 years.

Pleomorphic xanthoastrocytoma -three cases were studied two cases occurred in 41-60 years.

Anaplastic astrocytoma - out of the 21 cases, 12 cases occurred in 21-40 years age group and in 7 cases occurred in 41-60 years age group.

Glioblastoma multiforme- out of the 94 cases studied 57 cases (60.6%) occurred in an age group of 41-60 years.

TABLE NO 10 : CORRELATION OF AGE GROUP

WITH SEX OF GLIOMAS

Age group		SEX		Total
		Male	Female	
upto 20 years	Count	32	28	60
	%	19.0%	29.5%	22.8%
21-40 years	Count	53	26	79
	%	31.5%	27.4%	30.0%
41-60 Years	Count	65	33	98
	%	38.7%	34.7%	37.3%
61-80 years	Count	14	8	22
	%	8.3%	8.4%	8.4%
above 80 years	Count	4	0	4
	%	2.4%	0.0%	1.5%
Total	Count	168	95	263
	%	100.0%	100.0%	100.0%

P=0.218

In the above table, at all age groups males are most commonly affected than females.

CHART NO 10 : CORRELATION OF AGE GROUP WITH SEX OF GLIOMAS

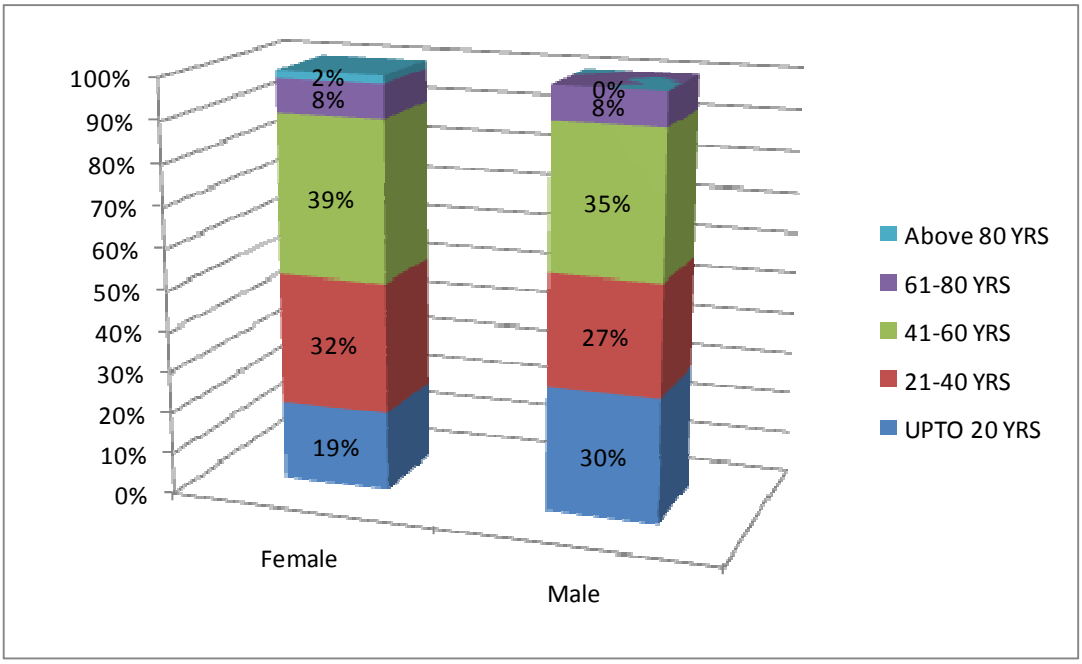


TABLE 10 A : MEDIAN AGE AT DIAGNOSIS

		AGE				
		Count	**Mean**	**Maximum**	**Minimum**	**Median**
SEX	Male	168	39.35	85.00	.60	40.00
	Female	95	35.39	78.00	2.00	37.00

The median age at diagnosis in males was 40 years,and in females was 37 years .

TABLE 11 CORRELATION OF SEX WITH

GRADE OF GLIOMA

			GRADE				Total
			I	II	III	IV	
SEX	Male	Count	25	62	21	60	168
		%	14.9%	36.9%	12.5%	35.7%	100.0%
	Female	Count	15	35	12	33	95
		%	15.8%	36.8%	12.6%	34.7%	100.0%
	Total	Count	40	97	33	93	263
		%	15.2%	36.9%	12.5%	35.4%	100.0%

P=0.997

It has been inferred from the table that grade IV tumours (the most malignant form of glioma) was common among male as compared to other grades of tumour. In WHO grade I and II tumours, there is an increase in incidence in females. This shows concurrence with the popular hypothesis that benign and low grade tumours are common in women while the more malignant forms are common in men.

CHART NO. 11 : CORRELATION OF SEX WITH WHO GRADE OF GLIOMA

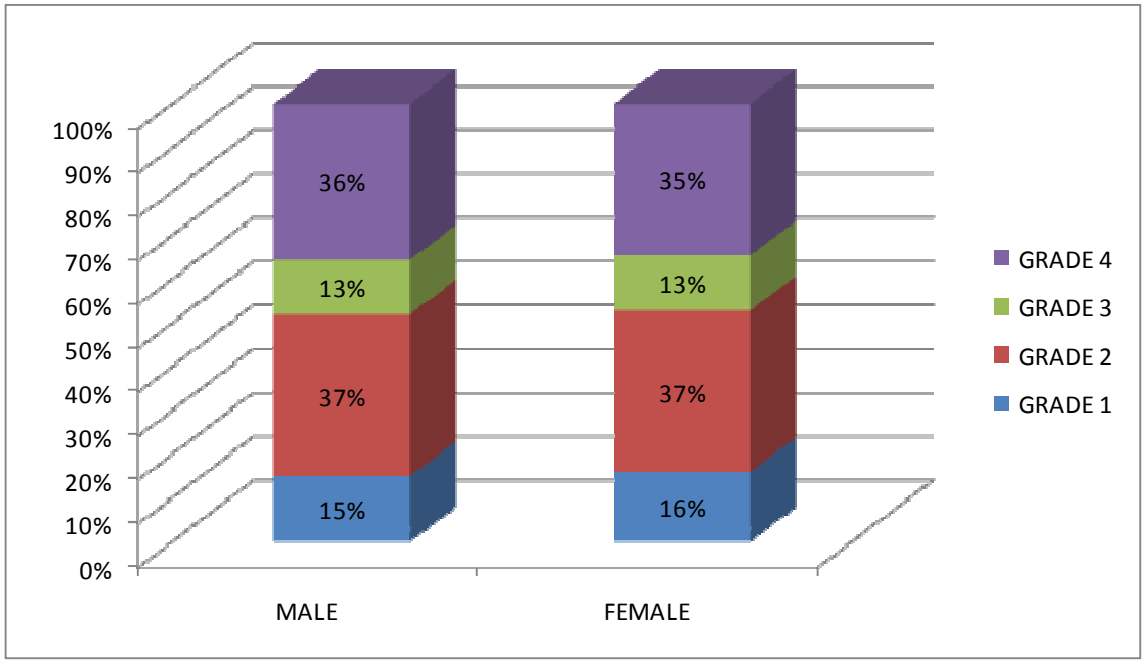


TABLE NO 12 DISTRIBUTION OF NUCLEAR PLEOMORPHISM IN GLIOMAS

Nuclear pleomorphism	No of cases	Percentage
1+	147	55.9%
2+	116	44.1%
total	263	1005

P-1+ -mild nuclear pleomorphism

PP-2+ marked nuclear pleomorphism

CHART NO 12 : DISTRIBUTION OF NUCLEAR PLEOMORPHISM IN GLIOMAS

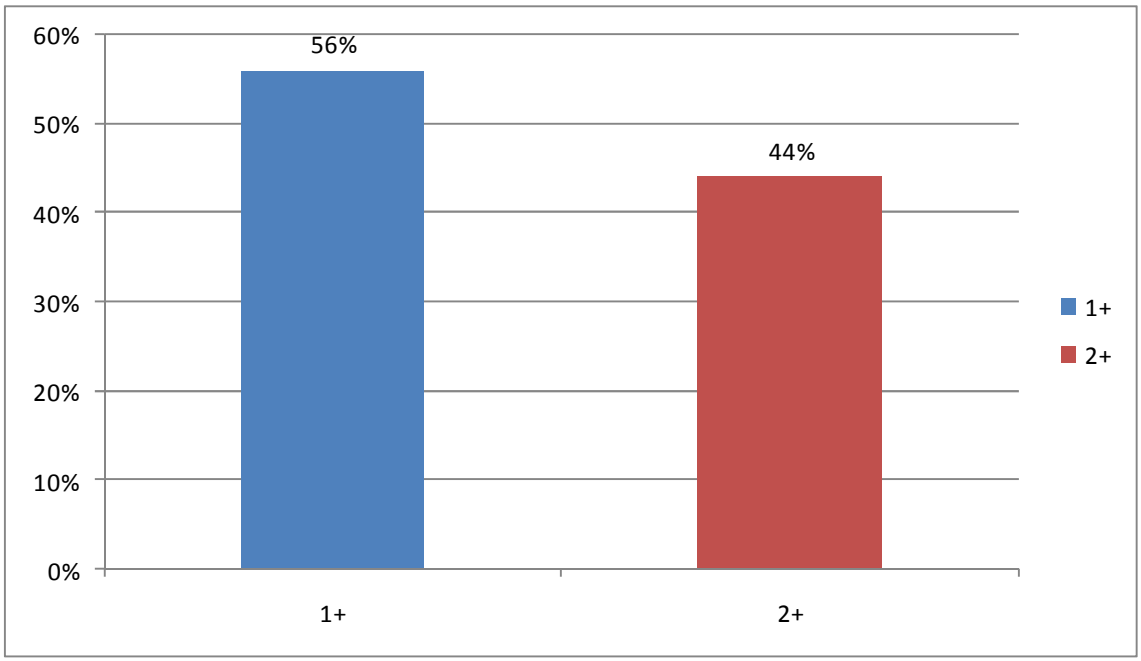


TABLE NO 13 A DISTRIDUTION OF MITOSES IN GLIOMAS

MITOSES	NO OF CASES	PERCENTAGE
ABSENT	29	11
PRESENT	234	89
TOTAL	263	100

TABLE NO 13-B DISTRIBUTION OF VASCULAR PROLIFERATION IN GLIOMAS

VASCULAR PROLIFERATION	NO OF CASES	PERCENTAGE
ABSENT	99	37.6%
PRESENT	164	62.3%
Total	263	100%

TABLE NO 13C-DISTRIBUTION OF NECROSES IN GLIOMAS

NECROSES	NO OF CASES	PERCENTAGE
Absent	**169**	**64.3%**
Present	**94**	**25.7%**
Total	**263**	**1005**

Chart no 13 (A,B,C) DISTRIBUTION OF MITOSES,VASCULAR PROLIFERATION,AND NECROSES

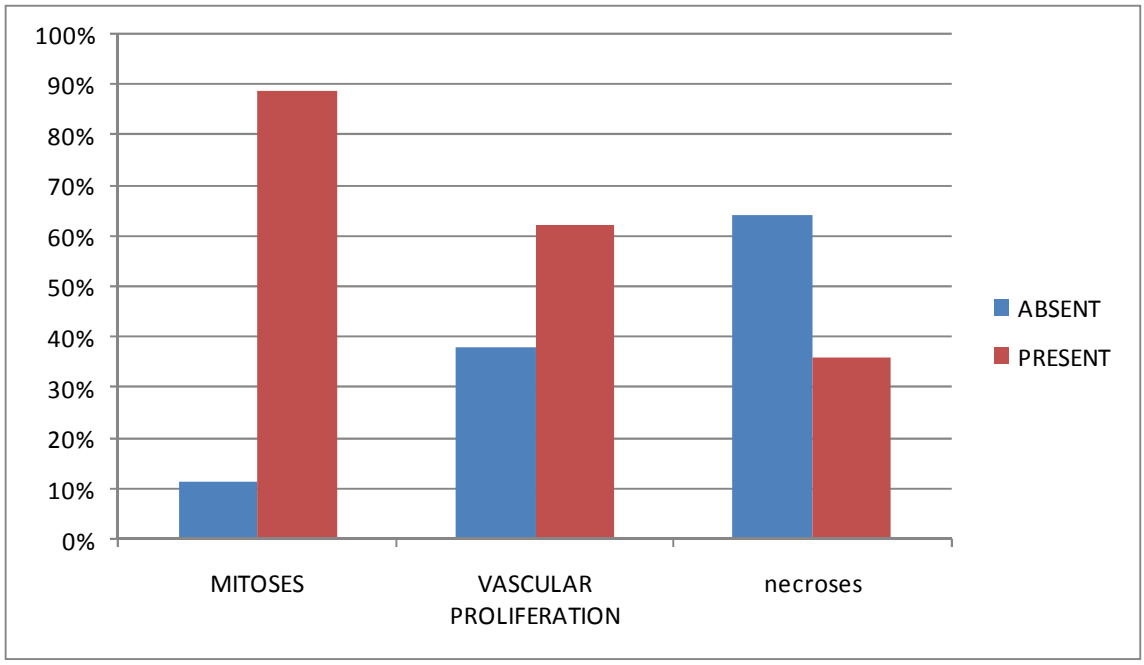
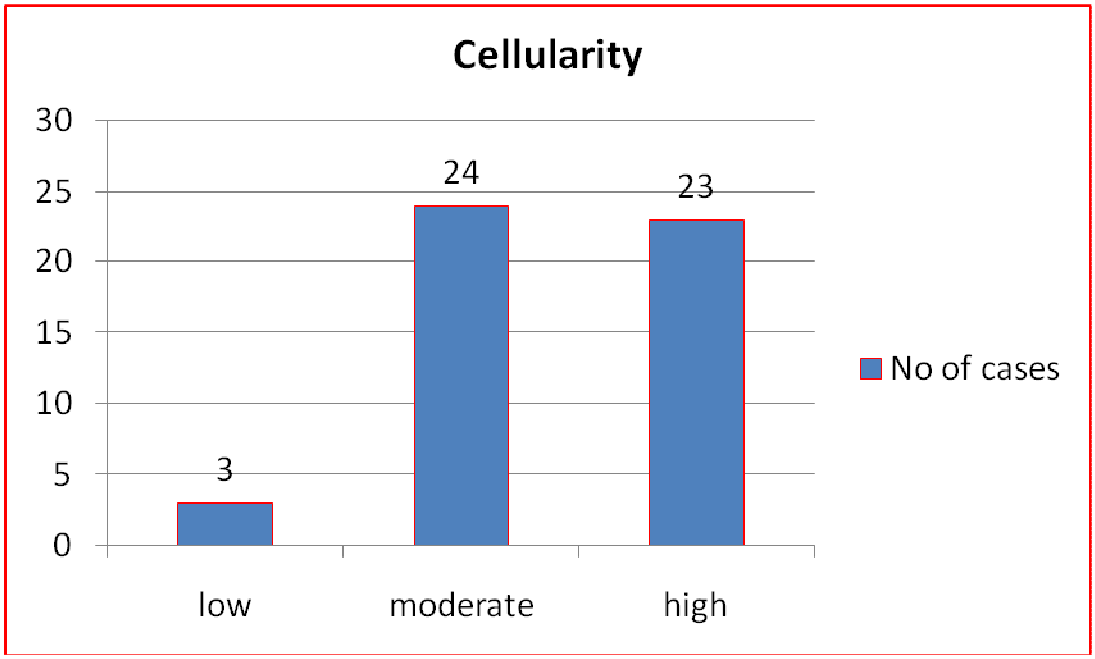


TABLE 13 D : DISTRIBUTION OF CELLULARITY IN GLIOMAS

CELLULARITY	NO OF CASES	PERCENTAGE
Low	3	6%%
Moderate	24	48%
High	23	46%



IMMUNOHISTOCHEMICAL EXAMINATION OF GLIOMAS – A CORRELATION WITH CD117 EXPRESSION

The expression of CD117 was studied in different grades of glioma. A subset of 50 cases constituting 9 cases of WHO grade I tumours, 14 cases of WHO grade II tumours, 8 cases of WHO grade III tumours, and 19 cases of WHO grade IV tumours were selected as representative of the whole sample of 263 cases. The formalin fixed paraffin embedded sections of the selected cases was subjected to immunohistochemical analysis with CD117. The list of cases described below.

TABLE 14 LIST OF CASES STUDIED FOR CD117 EXPRESSION

DIAGNOSES	GRADE	NO OF CASES
PILOCYTIC ASTROCYTOMA	I	9
DIFFUSE FIBRILLARY ASTROCYTOMA	II	4
OLIGO ASTROCYTOMA	II	2
PLEOMORPHIC XANTHOASTROCYTOMA	II	1
OLIGODENDROGLIOMA	II	4
EPENDYMOMA	II	3
ANAPLASTIC ASTROCYTOMA	III	8
GBM	IV	19
8 TYPES	FOUR GRADES	50

TABLE NO 15 DISTRIBUTION OF CD117 EXPRESSION IN GLIOMAS

PARAMETER	POSITIVE	NEGATIVE
CD117 EXPRESSION	27(54%)	23(46%)

CD117 was positive in 54% (27) of total cases.

CHART NO 15 : CD 117 EXPRESSION

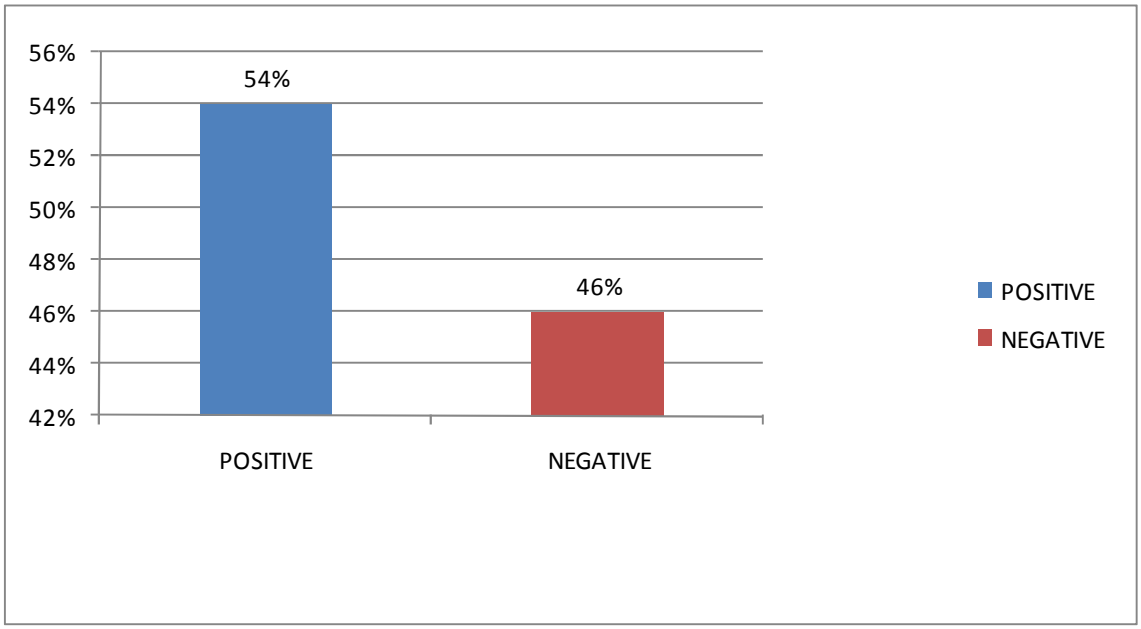
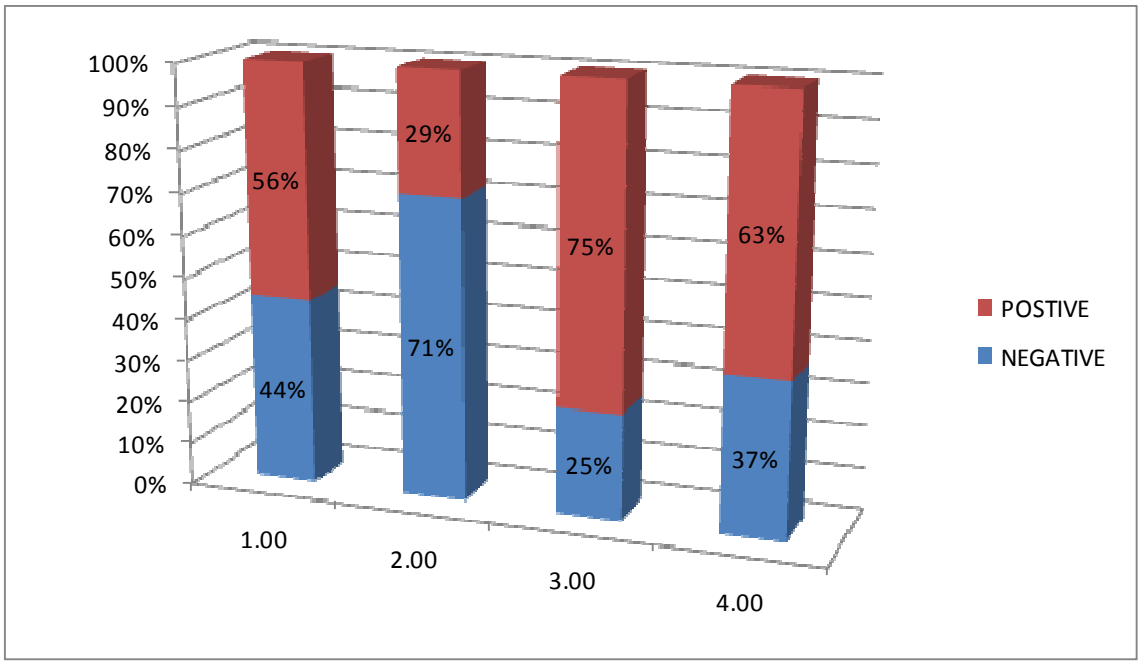


TABLE NO 16 CORRELATION OF CD117 EXPRESSION IN INDIVIDUAL GRADES

			CD117_of_stained_cells		Total
			NEG	POS	
GRADE	I	Count	4	5	9
		%	44.4%	55.6%	100.0%
	II	Count	10	4	14
		%	71.4%	28.6%	100.0%
	III	Count	2	6	8
		%	25.0%	75.0%	100.0%
	IV	Count	7	12	19
		%	36.8%	63.2%	100.0%
Total		Count	23	27	50
		%	46.0%	54.0%	100.0%

P=0.126

CHART 16 Correlation of CD117 exp in individual grades

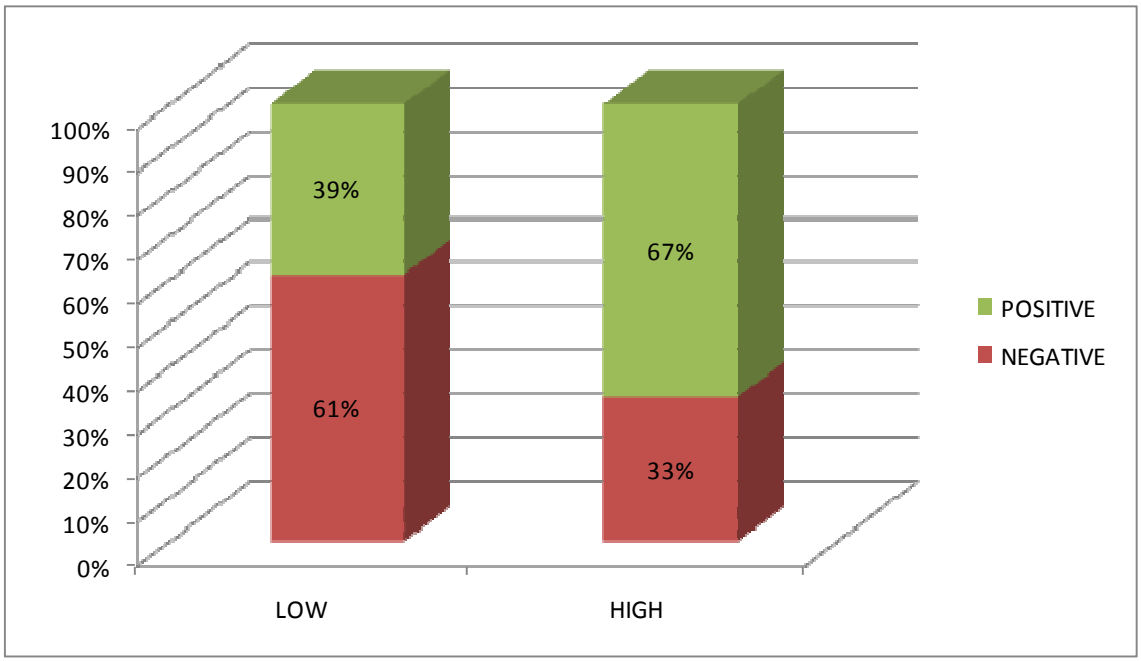


CDII7 expression was 56% positivity in WHO grade I gliomas. In case of grade II, grade III, and grade IV gliomas the percentage of positivity was 29%, 75%, and 63% respectively. The maximum positivity was seen in grade III & IV gliomas.

TABLE 17.CORRELATION OF CD117 EXPRESSION WITH LOW GRADE (I&II) AND HIGH GRADES(III&IV) GLIOMA

CD117 EXPRESSION WITH* GRADE Comparision						P value
			GRADE		Total	
			Low	high		
	CD117 NEG	Count	14	9	23	
		%	60.87%	33.33%	46.00%	
	CD117 POS	Count	9	18	27	
		%	39.13%	66.67%	54.00%	
Total		Count	23	27	50	
			100.00%	100.00%	100.00%	P< 0.05*

CHART NO17: CORRELATION OF CD117 EXPRESSION WITH LOW GRADE (I&II) AND HIGH GRADES (III&IV) GLIOMA



CD117 was positive in 39.13% of low grade tumours and 66.87% 0f high grade tumours inferring that maximum positivity was seen in high grade tumours .This correlation was found to be statistically significant.P <0.05

TABLE 18 : CORRELATION OF CD117 SCORE (% OF STAINED CELLS) WITH GRADE

			SCORE					Total
			0+	1+	2+	3+	4+	
GRADE	I	Count	4	0	2	1	2	9
		% within GRADE	44.4%	0.0%	22.2%	11.1%	22.2%	100.0%
	II	Count	10	0	0	3	1	14
		% within GRADE	71.4%	0.0%	0.0%	21.4%	7.1%	100.0%
	III	Count	2	0	2	3	1	8
		% within GRADE	25.0%	0.0%	25.0%	37.5%	12.5%	100.0%
	IV	Count	7	4	8	0	0	19
		% within GRADE	36.8%	21.1%	42.1%	0.0%	0.0%	100.0%
Total		Count	23	4	12	7	4	50
		% within GRADE	46.0%	8.0%	24.0%	14.0%	8.0%	100.0%

P=0.011*

0=negative, 1+=0-10% stained cells ,2+ 11-50% stained cells,3+=51-75% stained cells 4+=>75% stained cells.

In WHO grade I gliomas 44.4 % were 0+ and 2+,3+,4+ positivity was found with percent of 22.2%, 11.1%, 22.2% respectively.

In WHO grade II gliomas 71.4% were 0+ and 3+ positivity (21.4%) and 4+ positivity (7.1%)

In WHO grade III gliomas 25% are 0+ ,and 2+ positivity ,3+ positivity (37.5%), 4+ positivity in (12.5%) .

In WHO grade IV gliomas, 36.8 % were 0+, 21.1% were 1+ and 42.1% were 2+, Highest scores of 3+ and 4+ was seen in WHO grade III Tumours. So inferring that there is statistical correlation between CD117 score and grade of the tumour. (P=0.011*)

CHART NO 18: CORRELATION OF CD117 SCORE (% OF STAINED CELLS) WITH GRADE

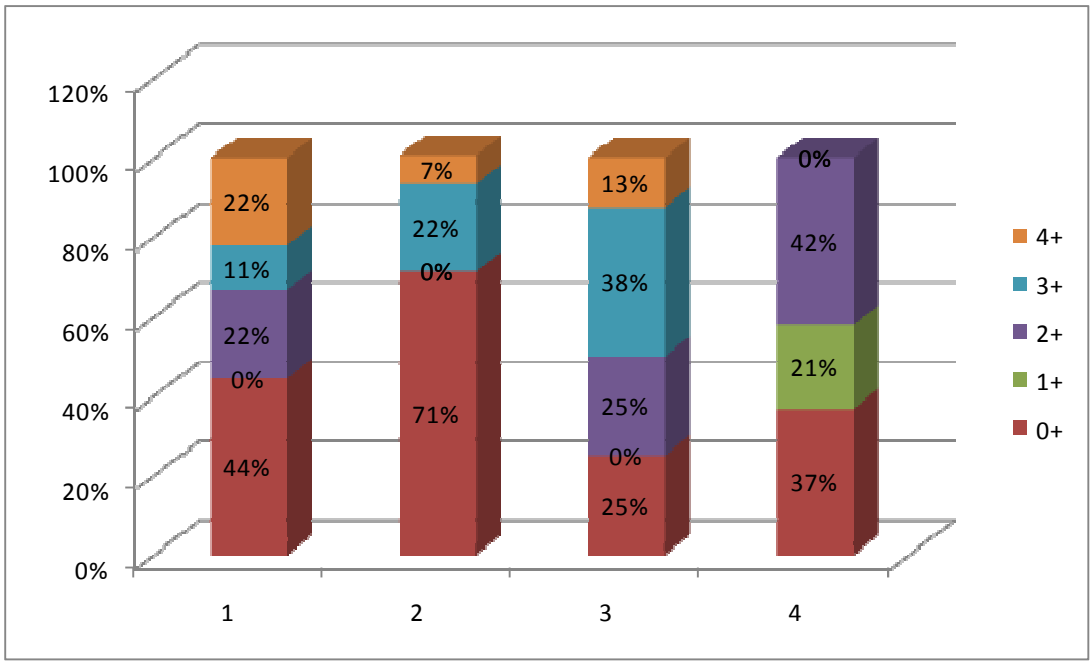


TABLE 19 : CORRELATION OF GRADE WITH CD117_stainigIntensity_

			CD117_stainigIntensity_				Total
			NEG	WEAK	MOD	STRONG	
GRADE	I	Count	4	1	2	2	9
		%	44.4%	11.1%	22.2%	22.2%	100.0%
	II	Count	10	1	2	1	14
		%	71.4%	7.1%	14.3%	7.1%	100.0%
	III	Count	2	3	1	2	8
		%	25.0%	37.5%	12.5%	25.0%	100.0%
	IV	Count	7	6	4	2	19
		%	36.8%	31.6%	21.1%	10.5%	100.0%
Total		Count	23	11	9	7	50
		%	46.0%	22.0%	18.0%	14.0%	100.0%

WHO Grade I tumours show both moderate and strong staining intensity in equal percentage (22.2%) WHO.grade II tumours show more moderate staining intensity (14.3%). WHO Grade III tumours (37.5%) and WHO grade IV tumours (22%) show more weak staining .This study shows no statistical correlation between staining intensity and grade of the tumour and thus not statistically significant.

CHART NO 19 CORRELATION OF GRADE WITH CD117_STAINIGINTENSITY

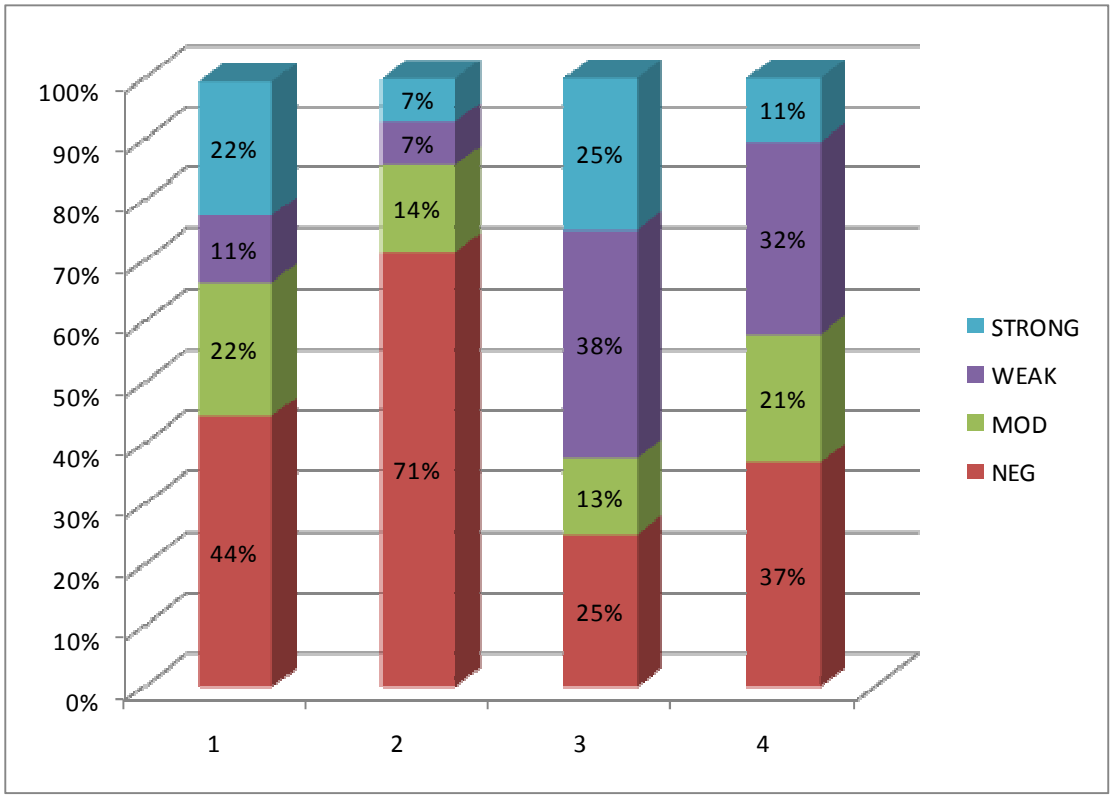


TABLE 20

CORRELATION OF AGE VS CD117_of_stained_cells					
			CD117_of_stained_cells		Total
			NEG	POS	
	UPTO 20 YRS	Count	6	5	11
		%	54.5%	45.5%	100.0%
	21-40 YRS	Count	9	10	19
		%	47.4%	52.6%	100.0%
	41-60 YRS	Count	8	10	18
		%	44.4%	55.6%	100.0%
	61-80 YRS	Count	0	2	2
		%	0.0%	100.0%	100.0%
Total		Count	23	27	50
		%	46.0%	54.0%	100.0%

P=0.560

In the above table, highest CD117 positivity was seen in age group of 61-80 years. Second highest positivity was seen in age group 41-60 years.

CHART 20: CORRELATION OF AGE VS CD117

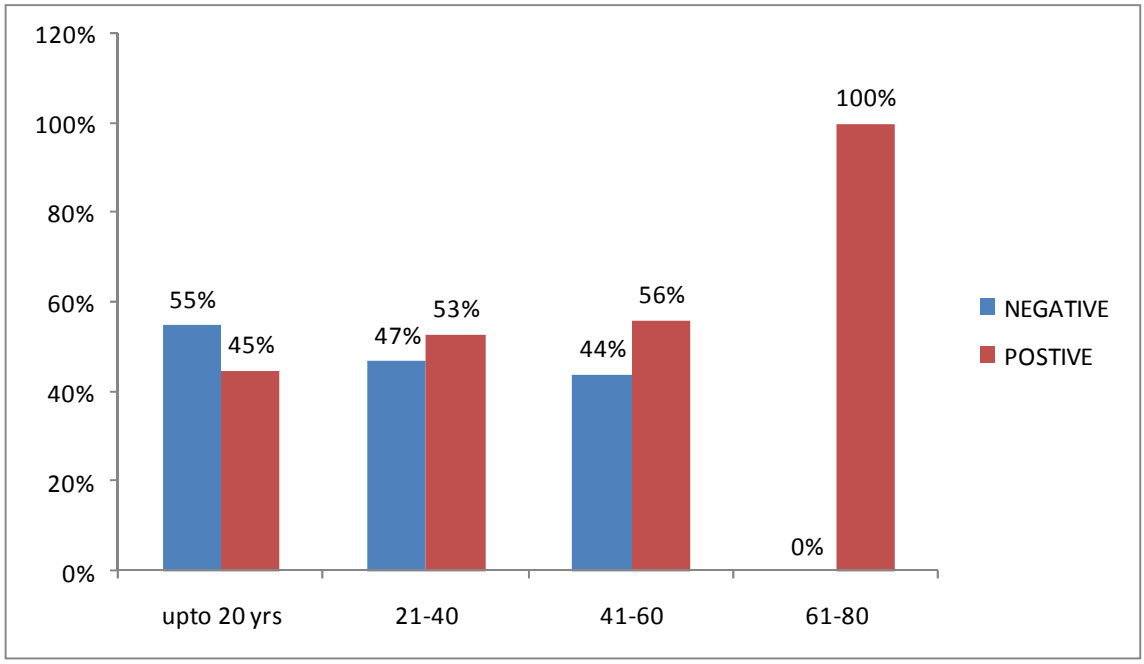


TABLE 21

CORRELATION of CDII 7 EXPRESSION WITH SEX

			CD117_of_stained_cells		Total
			NEG	POS	
SEX	F	Count	7	9	16
		%	43.8%	56.2%	100.0%
	M	Count	16	18	34
		%	47.1%	52.9%	100.0%
Total		Count	23	27	50
		%	46.0%	54.0%	100.0%

P=0.827

The above table shows that females have high (56.2 %) CD117 positivity when compared to males (52.9%).

CHART NO 21 CORRELATION OF CDII 7 EXPRESSION WITH SEX

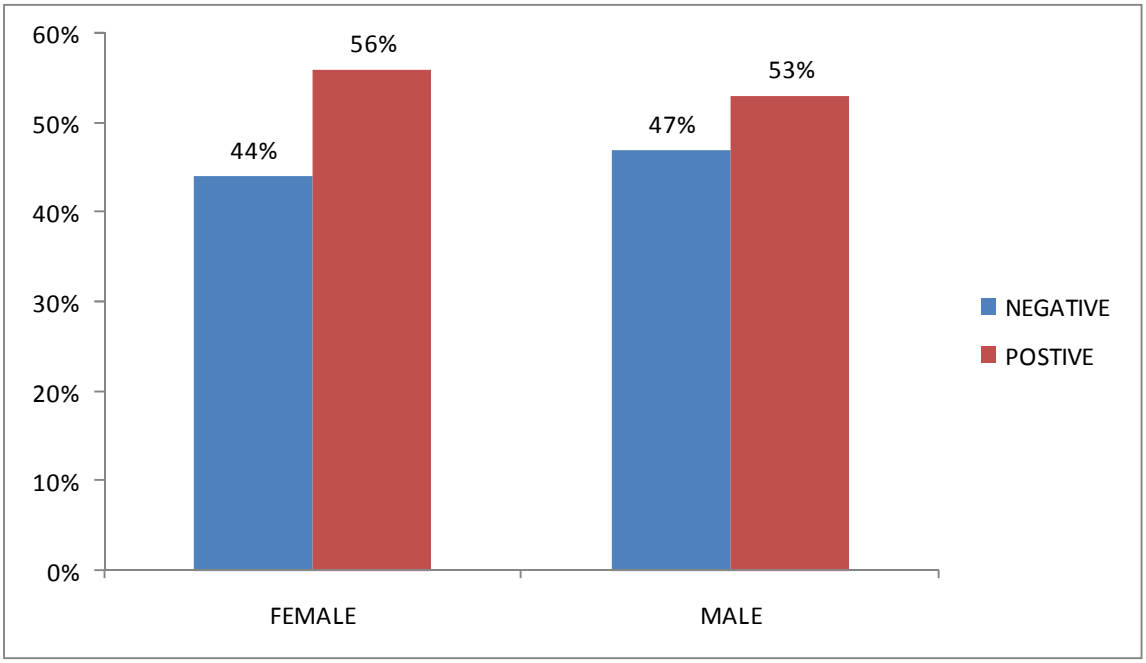


TABLE NO 22 CORRELATION OF SIDE WITH CDII7 EXPRESSION					
			CD117_of_stained_cells		Total
			NEG	POS	
SIDE	L	Count	6	11	17
		% within SIDE	35.3%	64.7%	100.0%
	M	Count	5	4	9
		% within SIDE	55.6%	44.4%	100.0%
	R	Count	12	12	24
		% within SIDE	50.0%	50.0%	100.0%
Total		Count	23	27	50
		% within SIDE	46.0%	54.0%	100.0%

In the above table highest percentage of CD117 positivity was seen in left hemisphere (64.7%)

Right hemisphere show 50% positivity, deep seated midline structures show 44.4%positivity. This study was not statistically significant .P=0.53

CHART NO 22 CORRELATION OF SIDE WITH CDII7 EXPRESSION

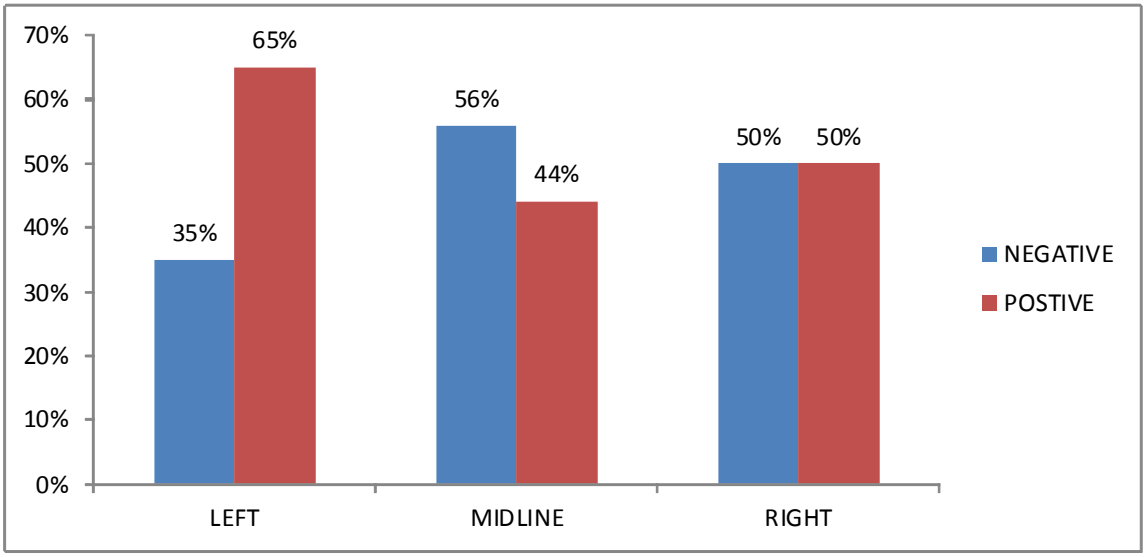


TABLE NO 23 CORRELATION OF CD117 WITH OTHER HISTOLOGICAL PARAMETERS

Tumour characteristics		**CD117 EXPRESSION**		**CHI – SQUARE TEST**
Description		Negative	Positive	
cellularity	1Low	3	0	P=0.041*
	2moderate	13	11	
	3high	7	16	
Nuclear pleomorphism	1+	16	11	P=0.042*
	2+	7	16	
Mitoses	Absent	3	2	P=0.508
	Present	20	25	
Vascular proliferation	Absent	9	7	P=0.318
	Present	14	20	
Necroses	Absent	15	16	P=0.665
	Present	8	11	

Correlation of CD117 expression with cellularity shows that those cases with high cellularity had highest percentage positivity (69.6%).The cases with low cellularity showed nil positivity. This study was statistically significant.P < 0.041

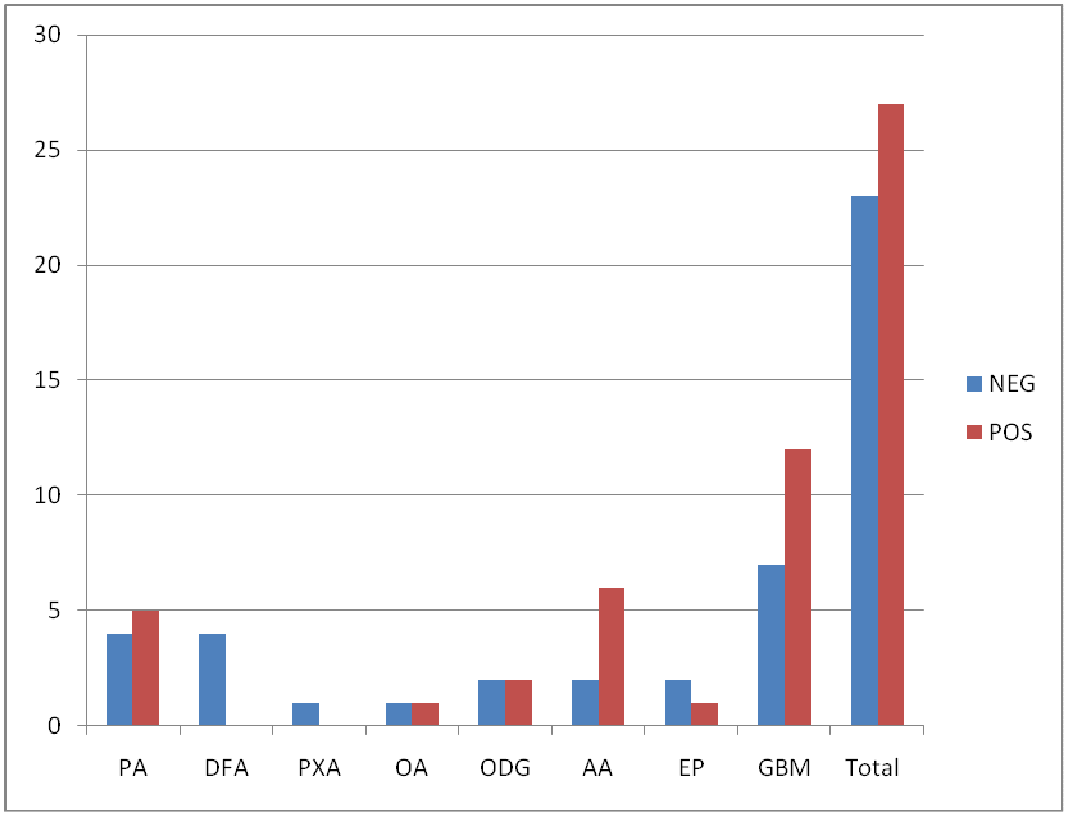
Correlation between nuclear pleomorphism and CD117 expression showed cells with marked nuclear pleomorphism had increased CD117 expression.The study was statistical significant.(P< 0.042.)

Correlation of CD117 with mitoses ,vascular proliferation and necroses showed no statsitical significance. There are no studies in literature to support it.

TABLE 24 : DISTRIBUTION OF CD117 EXPRESSION IN VARIOUS SUBTYPES OF GLIOMAS

		CD117_of_stained_cells		Total
		NEG	POS	
PA	Count	4	5	9
	%	44.4%	55.6%	100.0%
DFA	Count	4	0	4
	%	100.0%	0.0%	100.0%
PXA	Count	1	0	1
	%	100.0%	0.0%	100.0%
OA	Count	1	1	2
	%	50.0%	50.0%	100.0%
ODG	Count	2	2	4
	%	50.0%	50.0%	100.0%
AA	Count	2	6	8
	%	25.0%	75.0%	100.0%
	% within DIAGNOSIS	100.0%	0.0%	100.0%
EP	Count	2	1	1
	% within DIAGNOSIS	66.66%	33.33%	100.0%
GBM	Count	7	12	19
	% within DIAGNOSIS	36.8%	63.2%	100.0%
Total	Count	23	27	50
	% within DIAGNOSIS	46.0%	54.0%	100.0%

CHART NO 24 : DISTRIBUTION OF CD117 EXPRESSION IN VARIOUS SUBTYPES OF GLIOMAS

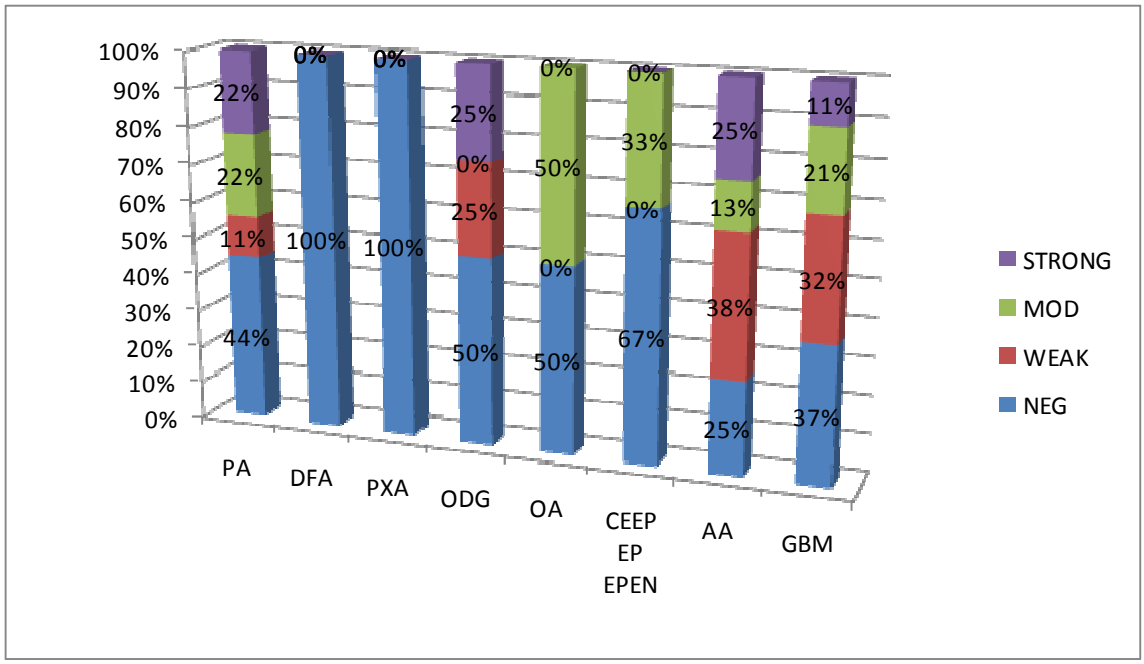


Anaplastic astrocytoma showed highest expression percentage (75%), second highest expression was seen in glioblastoma multiforme (63.2)% pilocytic astrocytoma showed 55%, oligodendroglioma showed 50% positivity. Diffuse fibrillary astrocytoma was 100% negative.

TABLE NO 25 : CORRELATION OF CD117 STAINING INTENSITY IN GLIOMA HISTOLOGICAL SUBTYPES

		NEG	WEAK	MOD	STRONG	
PA	Count	4	1	2	2	9
	%	44.44%	11.11%	22.22%	22.22%	18.00%
DFA	Count	4	0	0	0	4
	%	100.00%	0.00%	0.00%	0.00%	100.00%
PXA	Count	1	0	0	0	1
	%	100.00%	0.00%	0.00%	0.00%	100.00%
ODG	Count	2	1	0	1	4
	%	50.00%	25.00%	0.00%	25.00%	100.00%
OA	Count	1	0	1	0	2
	%	50.00%	0.00%	50.00%	0.00%	100.00%
EPENDYMOMA	Count	2	0	1	0	3
	%	66.67%	0.00%	33.33%	0.00%	100.00%
AA	Count	2	3	1	2	8
	%	25.00%	37.50%	12.50%	25.00%	100.00%
GBM	Count	7	6	4	2	19
	%	36.84%	31.58%	21.05%	10.53%	100.00%
TOTAL	Count	23	11	9	7	50
	%	46%	22%	18%	14%	100%

CHART NO 25 : CORRELATION OF CD117 STAINING INTENSITY IN GLIOMA HISTOLOGICAL SUBTYPES



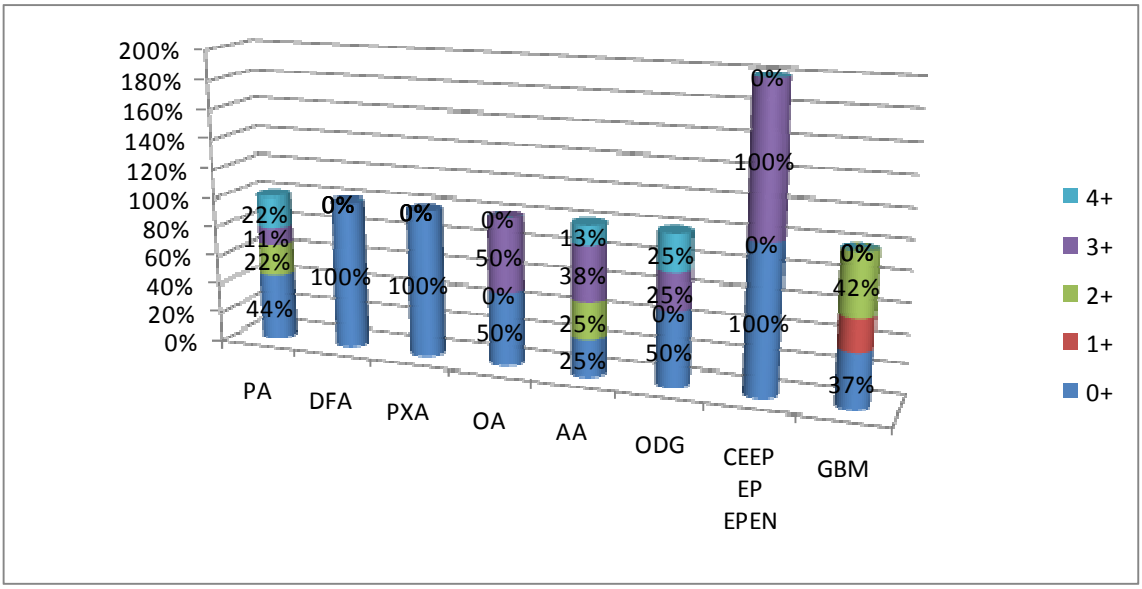
CEEP, EP, EPEN - Ependymoma

TABLE NO 26 CORRELATION OF CD117 SCORE WITH GLIOMA HISTOLOGICAL TYPES

		SCORE					Total
		0+	1+	2+	3+	4+	
PA	Count	4	0	2	1	2	9
	%	44.40%	0.00%	22.20%	11.10%	22.20%	100.00%
DFA	Count	4	0	0	0	0	4
	%	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%
PXA	Count	1	0	0	0	0	1
	%	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%
OA	Count	1	0	0	1	0	2
	%	50.00%	0.00%	0.00%	50.00%	0.00%	100.00%
AA	Count	2	0	2	3	1	8
	%	25.00%	0.00%	25.00%	37.50%	12.50%	100.00%
ODG	Count	2	0	0	1	1	4
	%	50.00%	0.00%	0.00%	25.00%	25.00%	100.00%
Ependymoma	Count	2	0	0	1	0	3
	%	100.00%	0.00%	0.00%	100.00 %	0.00%	100.00%
GBM	Count	7	4	8	0	0	19
	%	36.80%	21.10%	42.10%	0.00%	0.00%	100.00%
Total	Count	23	4	12	7	4	50
	%	46.00%	8.00%	24.00%	14.00%	8.00%	100.00%

P=0.332 0=negative, 1+=0-10% stained cells ,2+ 11-50% stained cells,3+=51-75%, 4+=>75% .

CHART NO 26 : CORRELATION OF CD117 SCORE WITH GLIOMA HISTOLOGICAL TYPES



CEEP, EP, EPEN – Ependymoma.

Correlation of individual hpe diagnoses with pattern of CD117 expression including,score and intensity of staining .

In pilocytic astrocytoma, out of the 9 cases ,2 cases were strong positive,2 moderate,1 weak. positive. they had strong and weak positive of equal incidence,and more than 25% cells were stained in all cases.

Diffuse fibrillary astrocytoma - all the four cases were negative. Oligodendroglioma - out of 4 cases, two showed positivity one was weak and one strong positive in > 50% of cells. Ependymoma - out of the three, one case was positive which showed moderate staining intensity in > 50% cells. Oligoastrocytoma - out of the two cases one case was positive showing moderate staining intensity in > 50% of cells. Pleomorphic xanthoastrocytoma was negative .

Anaplastic astrocytoma - out of the eight cases , 6 cases were positive ,2 cases showed strong positivity,one moderate and 3 weak positivity.more than 25% cells were stained in all cases ,one case showed more than 75% cells with strong positivity. Glioblastoma multiforme -12 cases showed positivity out of 19 cases.6 cases weak positive ,four moderate ,and two strong positive.only less than 50% cells were stained in all cases..

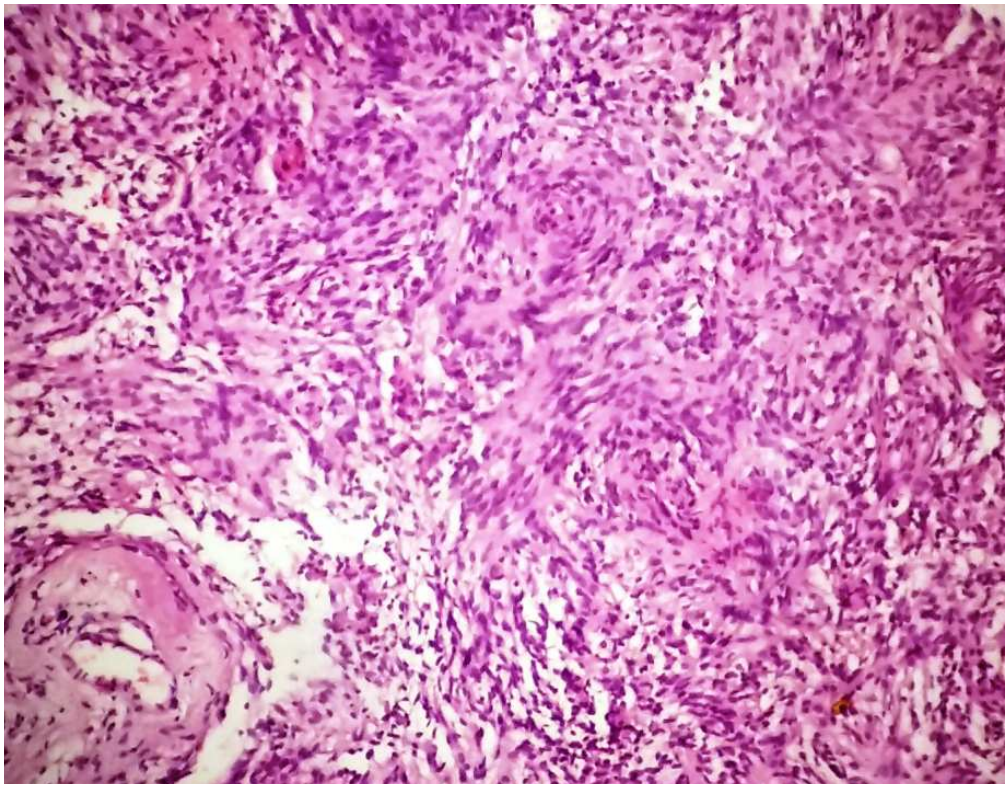


FIG 1: H & E 100 X PILOCYTIC ASTROCYTOMA

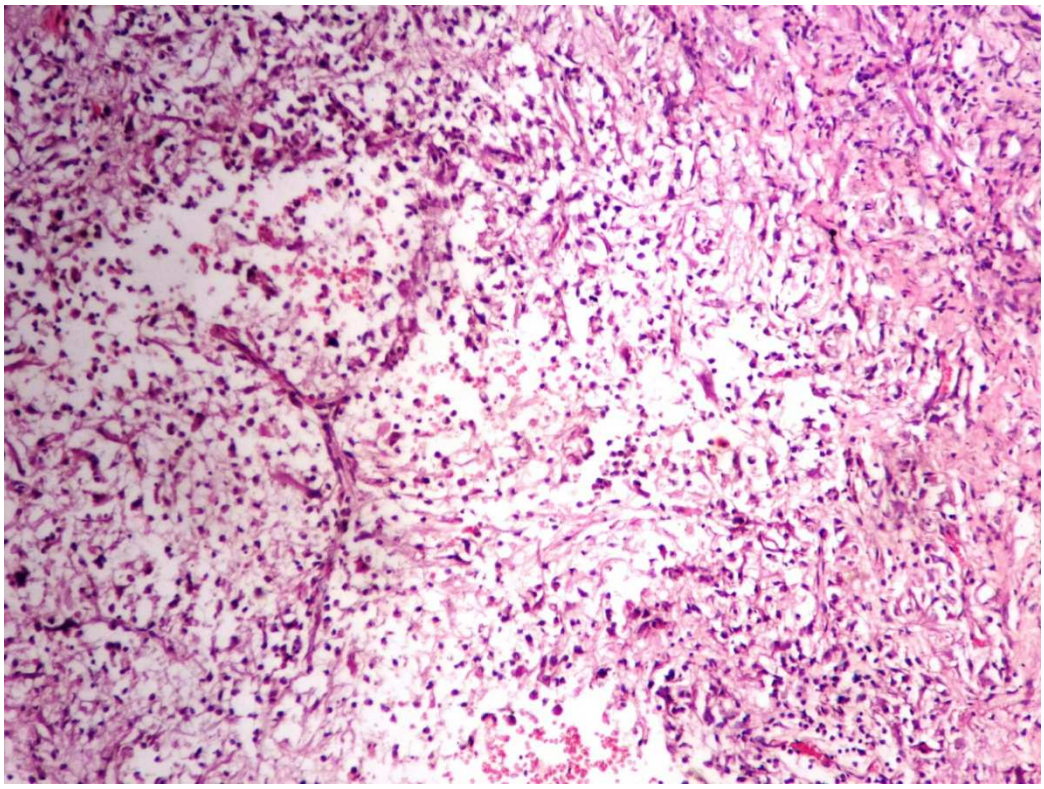


FIG NO 2: H & E 100X DIFFUSE FIBRILLARY ASTROCYTOMA

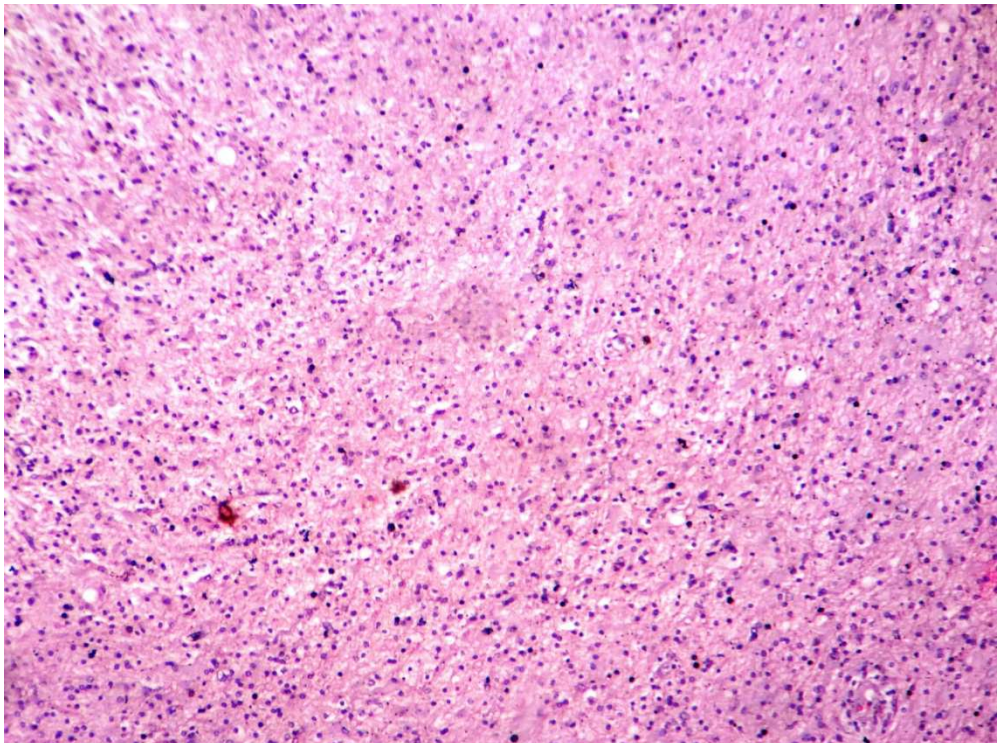


FIG 3: H & E 100X OLIGODENDROGLIOMA

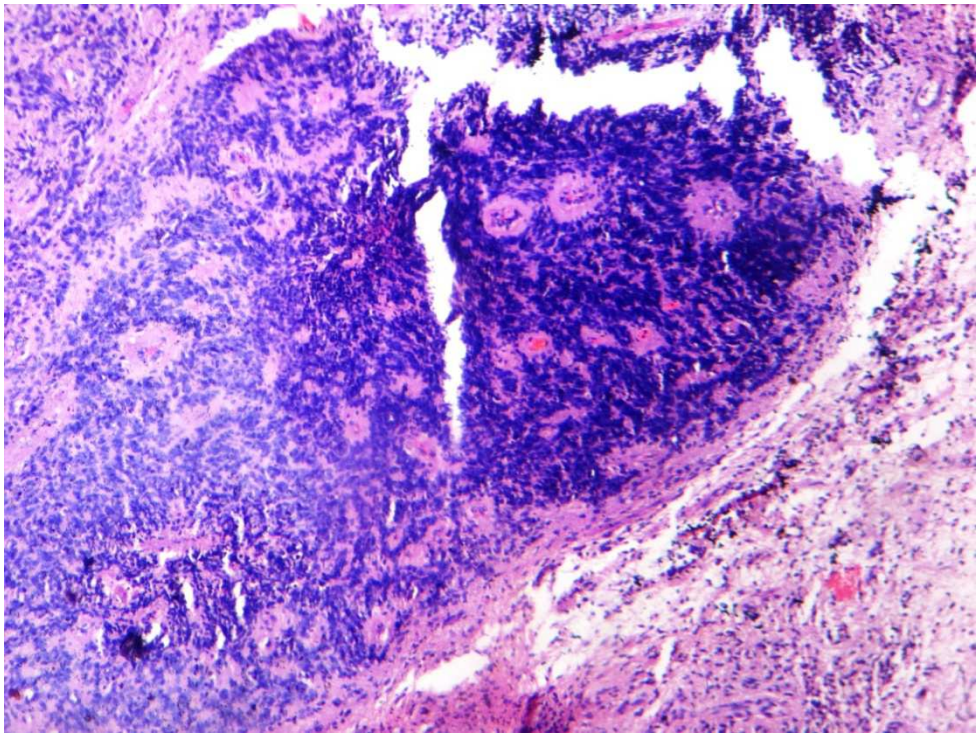


FIG NO 4: H & E 100X EPENDYMOMA

True rosettes and pseudo rosettes

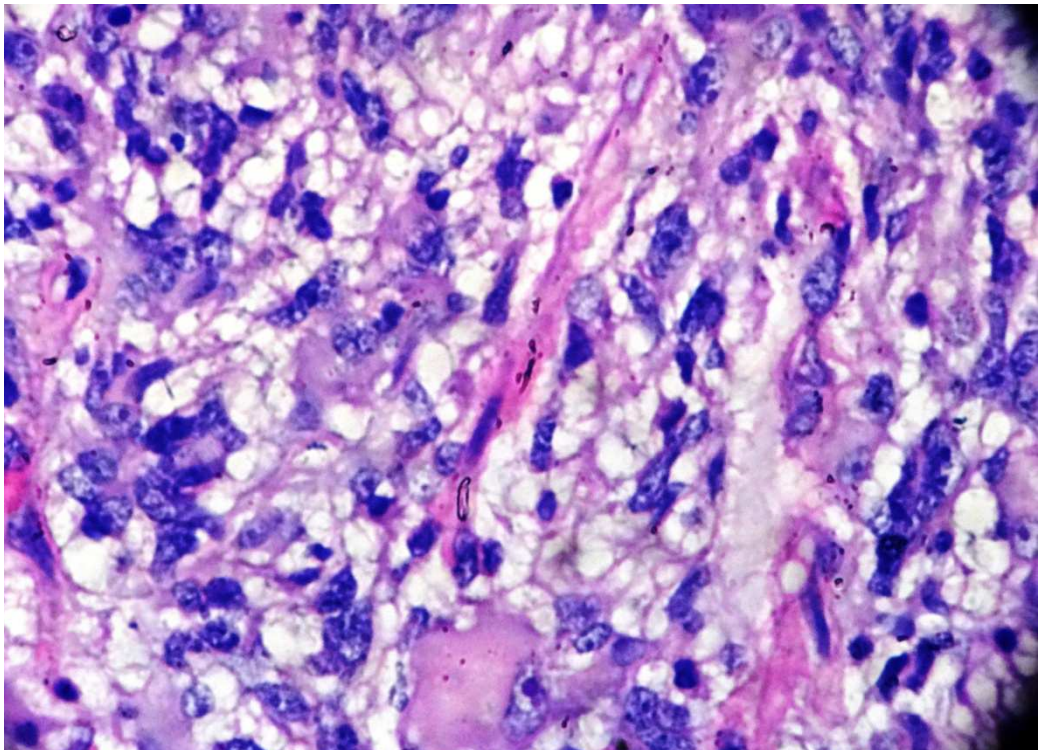


Fig NO 5: H & E 400 X ANAPLASTIC ASTROCYTOMA

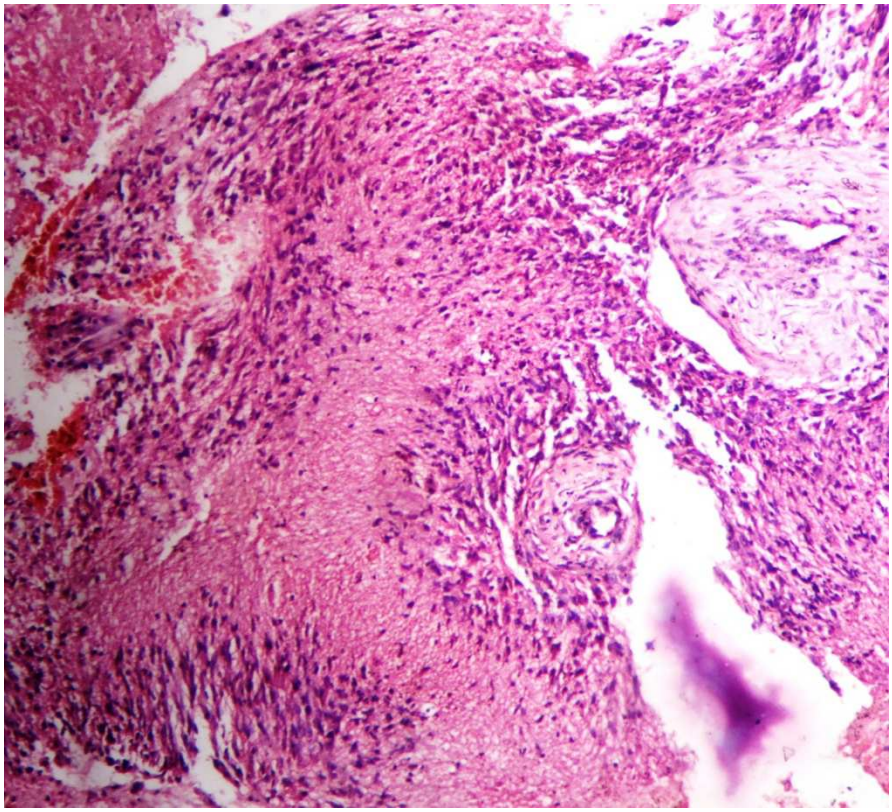


FIG NO 6: H & E 100 X GLIOBLASTOMA MULTIFORME

Endothelial proliferation and pseudopalisading necroses

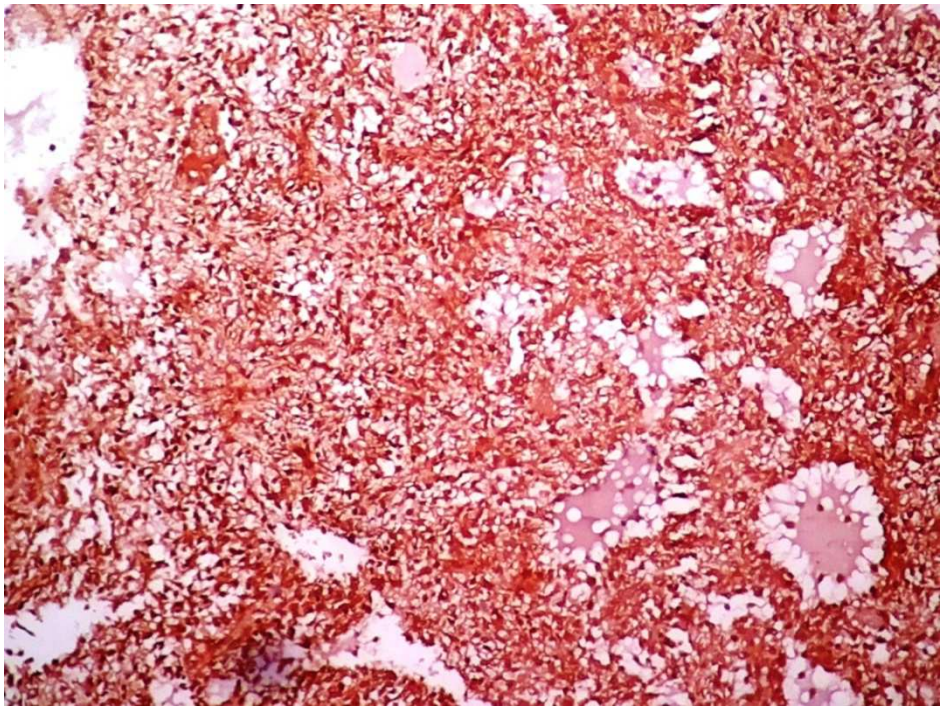


FIG 7: IHC CDII7 STRONG POSITIVE IN PILOCYTIC ASTROCYTOMA

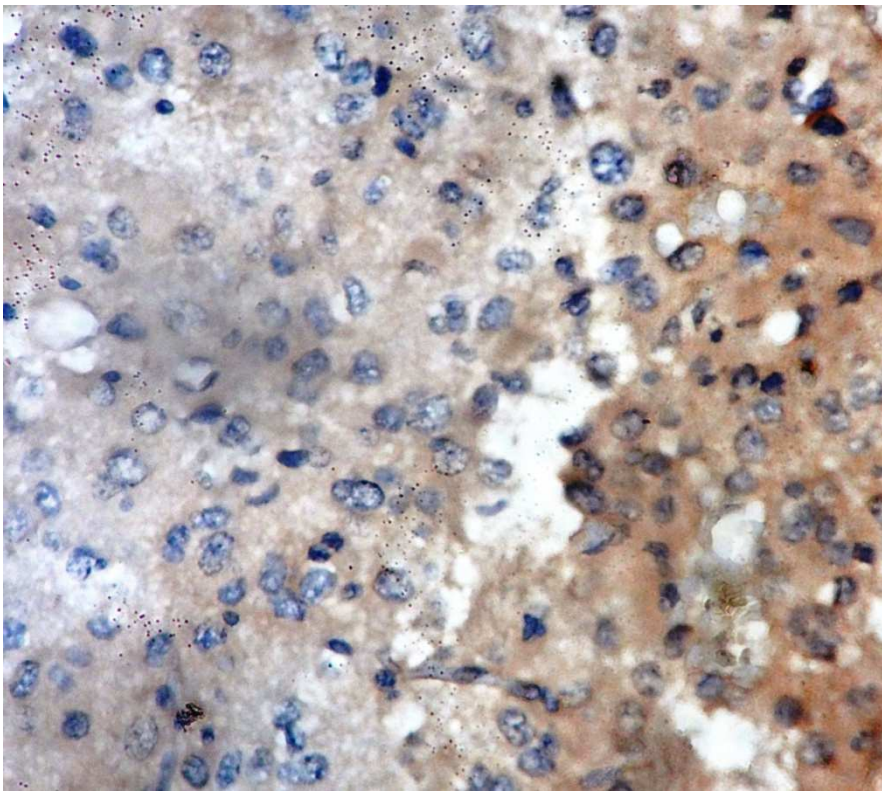


FIG NO 8: CD117 SHOWING MODERATE POSITIVITY IN OLIGODENDROGLIOMA

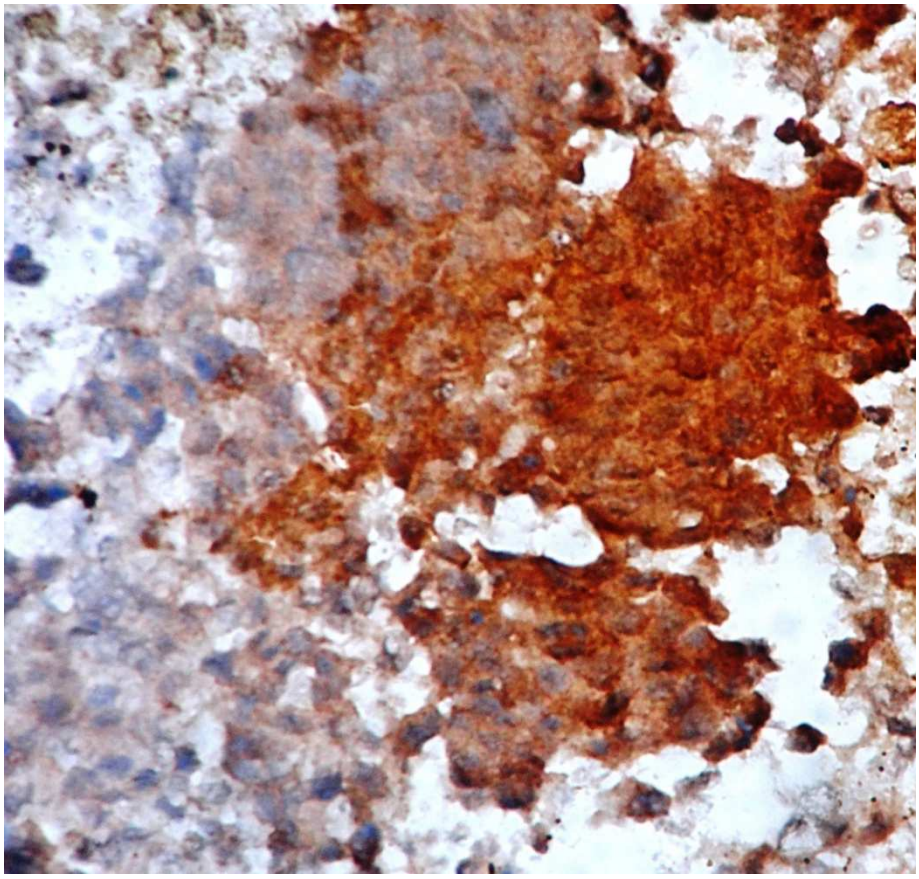


FIG NO 9: CD117 POSITIVE IN EPENDYMOMA

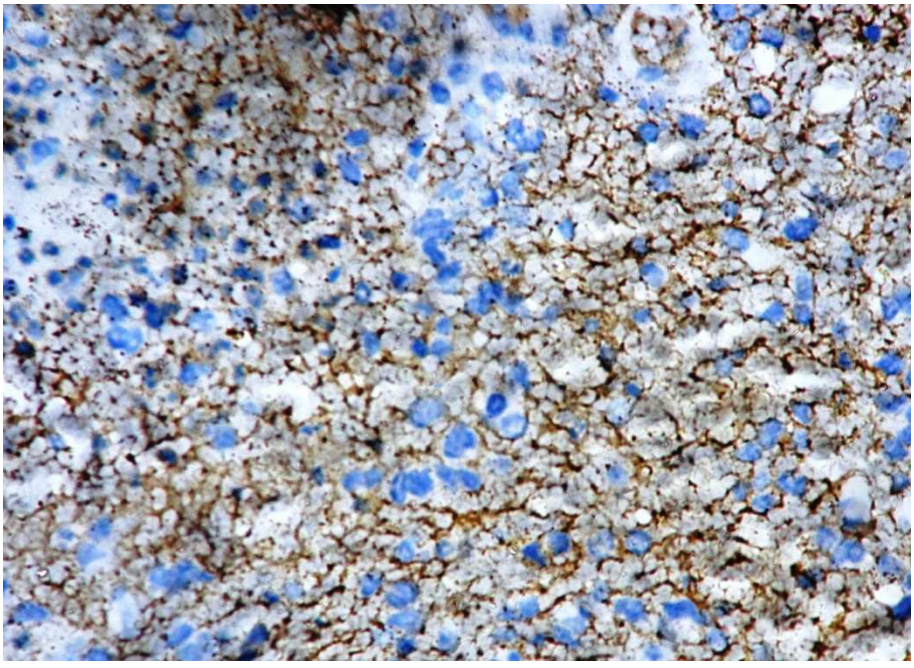


FIG NO 10: CD117 POSITIVE IN ANAPLASTIC ASTROCYTOMA

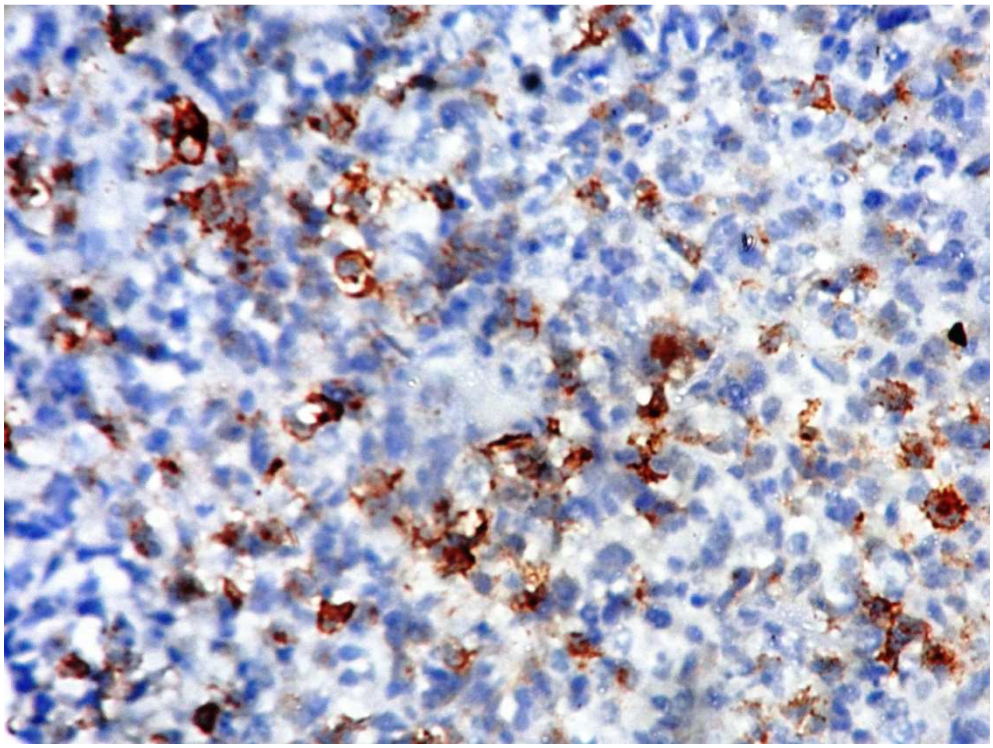


FIG NO 11: CD117 POSITIVE IN GLIOBLASTOMA MULTIFORME

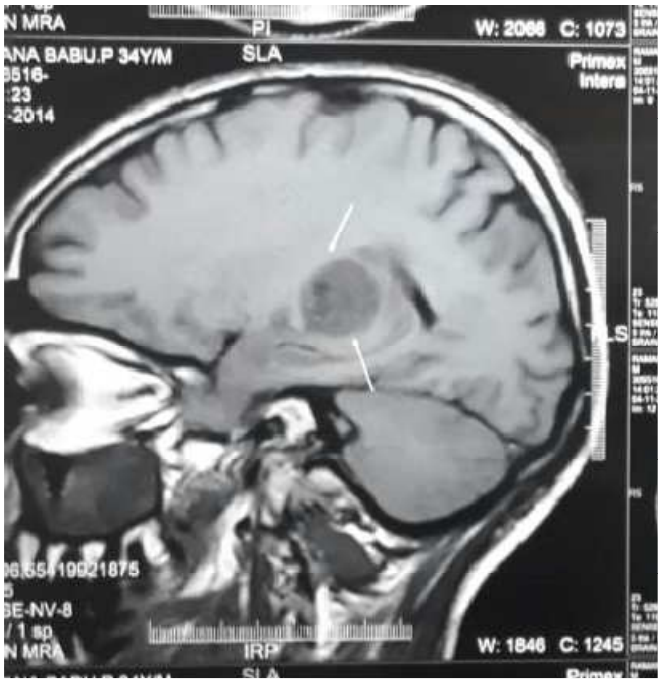


FIG 12: MRI PICTURE - PILOCYTIC ASTROCYTOMA

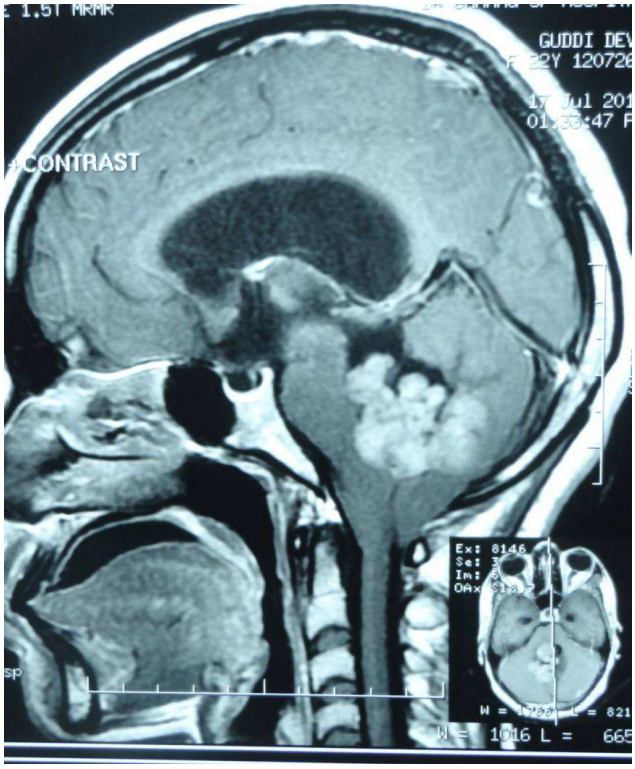


FIG 13: MRI PICTURE - EPENDYMOMA CONTRAST ENHANCING LESION IN FLOOR OF FOURTH VENTRICLE

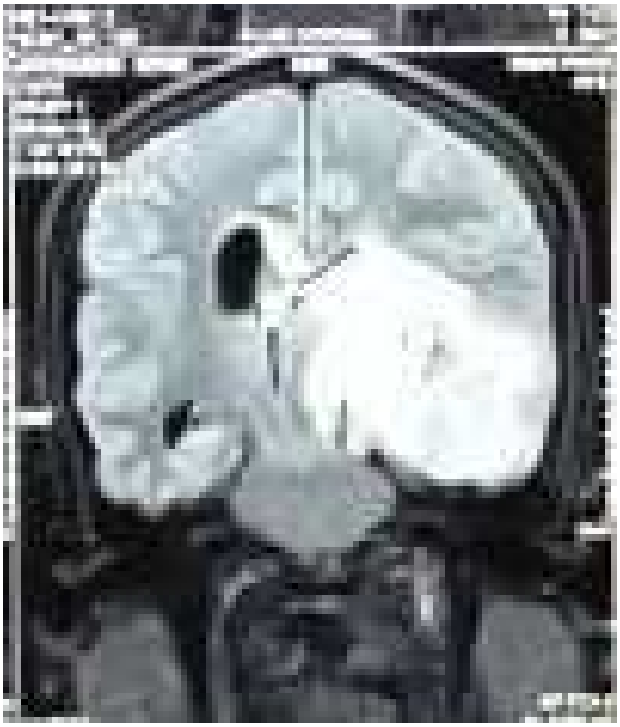


FIG NO 14: MRI PICTURE - OLIGODENDROGLIOMA

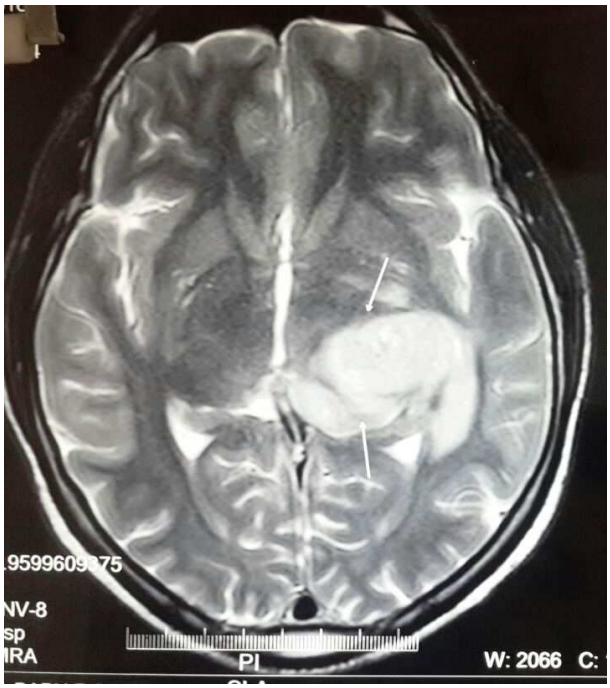


FIG NO 15: MRI PICTURE - GLIOBLASTOMA MULTIFORME

DISCUSSION

DISCUSSION

The incidence of nervous system tumours is increasing in both developed and developing countries in the present era involving adults. Paediatric population also show increasing occurrence of nervous system tumours. CNS tumours are rare neoplasms with 1-3% incidence[129] .Gliomas are most common malignancies in CNS tumours and they account for 40% of all primary brain neoplasms[130].

In the present study, histomorphological analysis was done for 263 cases of glioma while immunohistochemical evaluation was done for a subset of 50 cases . An evaluation of CD117 expression in cases of gliomas were done.

Madras Medical College being a tertiary referral centre, the relative frequency of gliomas among the neurosurgical cases was 31.4% among the entire neurospecimens.

In our study the peak incidence of gliomas was 41 -60 years. The maximum age observed was 85 years. It showed a mean age of 38 years with a standard deviation of 19.6. This is similar to study of Gurney et al[(131)], . and Vovoras et al[132]

WHO grade 1 tumour was most common in age group of less than 20 years (53.3%.).WHO grade II was most commonly seen in age group of 21-

40 years(50.6 %.). WHO grade III and IV tumours are commonly seen in the age group above 80 years (75%). There are no studies to correlate the age and grade of the tumours.

Comparision of sex incidence of gliomas.

In our study gliomas have a male preponderance , that is out of the 263 cases studied 63.9 % (168) of cases have occurred in males and 36.1 % (95 cases) of cases have occurred in females. This correlates with study of vovorosa et al [(132)l]but does not correlate with ICMR studies.[133.]

TABLE NO 27 : COMPARISION OF SEX INCIDENCE OF GLIOMAS

	Current study	**Vovorosa et al**
MALE	63.9%	55.6%
FEMALE	36.1%	44.45%

The median age at diagnoses is higher in males than females. It correlates with observation of denis strongman et al from australia.[(130)]

TABLE NO 28 COMPARISION OF MEDIAN AGE AT DIAGNOSIS

	DENIS STRANGMAN ET AL	CURRENT STUDY
MALE	60-64	40
FEMALE	55-59	37

Comparision of distribution of histopathological subtypes of gliomas

From the data in our institute it is clear that out of the 263 gliomas studied in a two year period Glioblastoma multiforme was the most common one accounting for 94 cases (35.7%). Pilocytic astrocytoma was the second most common glioma accounting for 38 cases (14.4%). Least common were pleomorphic xanthoastrocytoma (1.1%), oliogoastrocytoma(1.9%), anaplasticoliogoastrocytoma,(0.8%), Anaplastic oligodendroglioma(0.8)%. These findings are in correlation with study of Larjavaara etal [(134)]

TABLE NO 29 COMPARISION OF DISTRIBUTION OF HISTOPATHOLOGICAL SUBTYPES OF GLIOMAS

		Our study	Larjavaara et al.:
1.	Pilocytic Astrocytoma	14.4	5
2.	Diffuse astrocytoma	7.6	14
3.	Oligo astrocytoma	1.9	10%
4.	Oligodendroglioma	7.6	11%
5.	Ependymoma	9.1	3%
6.	Anaplastic Astrocytoma	8.0	9%
7.	Glioblastoma Multiforme	35.7	47%
8.	Other Gliomas	7%	<1%
9.	Other Astrocytoma	2.7%	<1%
	Total	100.0	

Comparision of side of brain involved in glioma

In our study, Right hemisphere of brain was most commonly involved 44.8% than the left 33.07%, and other midline deep structures 22.05% .This correlates with study of larjavara et al[134]

TABLE NO 30 COMPARISION OF SIDE OF BRAIN INVOLVED IN GLIOMA

SIDE	Current study	Larjavara et al
Right	44.8%	50
Left	33.07%	41
Midline	22.05	9

Comparision of site incidence of gliomas

In our study The cerebral lobes is most commonly involved by the glioma that is 79% of which frontal lobe has the highest incidence of cases accounting to 19.8 %(52 cases). The second most common is the temporoparietal region accounting to 12.9 %(34 cases).The occipital lobe showed the least common involvement accounting to(4.6%)12 cases.

The findings in our study is more or less similar to the study of Larjavaara et al, except for parietal lobe involvement which is only 6.5% in our study when compared to Larjavaara et al[134]in which the parietal lobe involvement was 14%.

TABLE NO 31 ;SITE INCIDENCE OF GLIOMAS COMPARATIVE STUDY

	Larjavaara et al	Our study
Frontal	40%	44.2%
Temporal	29%	24.3%
Parietal	14%	6.5%
Occipital	3%	4.6%
Cerebellum	1.5%	2.7%
Ventricles	2.2%	5.3%
Brain stem	4.1%	10.9%
Deep structures areas	14%	10.5%

In our study ,in the spinal cord out of the 14 cases, intradural intramedullary lesions were most common accounting to 10 cases(3.8%) ,intradural extra medullary lesions was second most common accounting to

3 cases (1.1%) and one case was extradural lesion accounting to 0.4% of total cases. There are no studies in literature to correlate these lesions.

Comparision of WHO grade of tumours

In our study, it was found that the WHO grade II tumours were of maximum incidence (36.9 %),the second most common was WHO grade IV tumours(35.4%) ,the third common was WHO grade I tumours(15.2%),and fourth place was taken by WHO grade III tumours(12.5 %.) These observations correlated with studies of Larjavara et al.[134]

TABLE NO 32

WHO GRADE	LARJAAVARA ET AL	CURRENT STUDY
I	5.13%	15.2%
II	38.9%	36.9%
III	9.36%	12.5%
IV	46.5%	35.4%

Comparision of grade with sex

It has been inferred from the table that WHO grade IV tumours (the most malignant form of glioma) was common among male as compared to other grades of tumour. WHO grade I and II tumours - slight increase in incidence in females. This shows concurrence with the popular hypothesis that

benign and low grade tumours are common in women while the more malignant forms are common in men. There are no studies found in literature. The sex distribution of gliomas in our study did not correlate with study of vovorosa et al.

Comparision of diagnosis with sex (Table – 34)

In our study most of the tumours have male predilection except oligoastrocytoma and ependymoma which show female predominance.These findings did not correlate with the study of vovorosa et al.[132]

TABLE NO 34

Tumour types	D. Vovoras *et al*	Our study
	Sex	
	Males	Males
Specified low grade astrocytic tumor	56.31	14.88%
Glioblastoma and anaplastic astrocytoma	57.11	44.64%
Astrocytoma NOS	55.13	28%
Other Glioma	54.68	6.54%
Ependynoma	55.06	8.333

Comparision of tumour types with age groups (Table – 35)

Pilocytic astrocytoma was found to most commonly affect the age group of 0 to 20 years. Myxopapillary ependymoma was found commonly to

affect the age group of 20- 40 years. Diffuse fibrillary astrocytoma was most commonly affect the age group of 21-40 years.Diffuse astrocytoma showed maximum incidence in 20-60 years.Pleomorphic xanthoastrocytoma- three cases were studied, two cases occurred in 41-60 years. (66.7 %). Anaplastic astrocytoma , occurred in 21-40 years age group following a relative percent of 57.1% . Glioblastoma multiforme maximum cases occurred in an age group of 41-60 years with 60.6%. Above study correlates with the study of Dr.D.vovorasa et al[132]

TABLE NO 35

Types	D. Vovoras *et al*			OUR STUDY		
	AGE			age		
	0-19	20-64	>65	0-19	20-64	>65
Specified low grade astrocytic tumor	1820 (32%)	1743 (6%)	347 (2%)	33 (55%)	8 (5%)	0 (0%)
Glioblastoma and anaplastic astrocytoma	605 (11%)	14858 (52%)	12496 (72%)	2 (3%)	93 (53%)	20 (77%)
Astrocytoma NOS	1315 (23%)	5165 (18%)	2385 (14%)	4 (7%)	41 (23%)	4 (15%)
Other Glioma	1399 (24%)	5544 (19%)	1971 (11%)	3 (5%)	23 (13%)	2 (8%)
Ependynoma	588 (10%)	1204 (4%)	184 (1%)	18 (30%)	12 (7%)	0 (0%)
	5727	28514	17383	60	177	26

IMMUNOHISTOCHEMISTRY IN NERVOUS SYSTEM TUMOURS:

The expression of CD117 was studied in different grades of glioma. A subset of 50 cases constituting of all four grades of glioma as representative of sample of 263 cases was analysed immunehistochemically. The formalin fixed paraffin embedded section was subjected to immunohistochemical analysis with CD117.

Among the 50 CASES CD117 expression was seen in 54% of tumours.

TABLE NO 36 COMPARISION OF CD117 POSITIVITY WITH WORLD STATISTICS

Cetin et al	75%
Parvin et al	76%
arash degan et al.	42%
Current study	54%

CD117 expression was lower than the studies of parvin et al[127],and cetin et al, higher than studies of arash degan et al[128].

COMPARATIVE STUDY OF CD117 POSITIVITY WITH GRADE

TABLE NO 37 COMPARISON OF CD117 POSITIVITY WITH GRADE AS LOW AND HIGH GRADE

	CURRENT STUDY	Parvin et al	Arash deghan et al
Low	39.13	68%	21.2%
High	66.67	84%	61.1%

CD117 was positive in 39.13 % of low grade tumours and 67% of high grade tumours inferring that maximum positivity was seen in high grade tumours .This correlation was found to be statistically significant with P value of0.05*.The study correlated with study of parvin et al[127],arash devgan et al [128].

COMPARATIVE STUDY OF % EXPRESSION OF CELLS WITH GRADE OF THE TUMOUR

TABLE NO 38 COMPARATIVE STUDY OF % EXPRESSION OF CELLS WITH GRADE OF THE TUMOUR

SCORE	CURRENT STUDY		PARVIN ET AL	
	Low	High	Low	High
0+	60.86%	33.33%	32	16
1+	0	14.81%	12	8
2+	8.69%	37.03%	28	32
3+	17.39%	11.11%	28	16
4+	13.04%	3.7%	0	28

0=negative, 1+=0-10% stained cells ,2+ 11-50% stained cells,3+=51-75% 4+=>75% .[128]

Low grade gliomas had maximum % of 3+ and high grade gliomas had maximum % of 2+.This observation did not correlate with the studies of parvin et al.[127]

Comparision of the intensity of stained cells with grade of the tumour-(TABLE NO 39)

WHO Grade I tumours show both moderate and strong staining intensity in equal percent (22.2)%.WHO GRADE II tumours show more of moderate staining intensity.(14.3%) WHO Grade III tumours (37.5%) and IV tumours (22%) show more of weak staining. This study shows no statistical correlation between staining intensity and grade of the tumour These observations did not correlate with study of parvin et al.[127]

TABLE NO 39

	Parvin et al		**Current study**	
	LOW-25	**HIGH-25**	**LOW-23**	**HIGH-27**
NO	32%	16%	60.8%	33.33%
Weak	36%	32%	17.39%	33.33%
Moderate	24%	32%	8.69%	18.51%%
STRONG	8%	20%	13.04%	14.8%

Comparision of individual HPE diagnoses with pattern of CD117 expression including score and intensity of staining .(Table -40)

In pilocytic astrocytoma, out 9 cases, 2cases strong positive,2 moderate,1 weak positive and more than 25% cells were stained in all cases.

Diffuse fibrillary astrocytoma and Pleomorphic xanthoastrocytoma were negative.

Oligodendroglioma - out of 4 cases two showed positivity one was weak and one strong positive , in > 50% of cells in both cases.

Ependymoma- out of the three cases one case was positive showing moderate staining intensity in > 50% cells.

Oligoastrocytoma- out of the two cases one was positive showing moderate staining intensity in > 50% of cells..

Anaplastic astrocytoma - out of the eight cases studied 6 cases were positive ,2 cases showed strong positivity,one moderate positive and 3 were weak positive and more than 25% cells were stained in all cases ,one case showed 4+ with strong staining intensity.

Glioblastoma multiforme -12 cases showed positivity out of 19 cases.6 cases were weakly stained ,four moderately stained ,and two strong positive. Only less than 50% cells were stained in all cases.

Our study did not correlate with study of arash devgan et al [128]in cases of pilocytic astrocytoma ,diffuse astrocytoma and oligodendroglioma. It coincided in cases of ependymoma ,anaplastic astrocytoma,and glioblastoma multiforme.

TABLE NO 40 COMPARISION OF CD117 EXPRESSION SCORE IN GLIOMA SUBTYPES WITH OTHER STUDIES.

DIAGNOSIS		0+	1+	2+	3+	4+
Pilocytic astrocytoma	Arash devgan et al	4	0	0	o	O
		100%				
	Current STUDY	4	0	2	1	2
		44.4%	0.0%	22.2%	11.1%	22.2%
Diffuse astrocytoma	Arash devgan et al	17	1	3		
		81%	5%	14%		
	Current study	4	0	0		
		100%	0	0		
Oligodendr	Arash devgan et al	4	1	0		
		80%	20%	0		
Oglioma	Current study %	2	0	0	1	1
		50 %	0.0%	0.0%	25.0 %	25.0%
ependymoma	Arash devgan et al %	1	2			
		33.3%	66.6%			
	Current study %	2	0	0	1	
		66.66 %	0	0	33.33 %	
Anaplastic astrocytom	Arash devgan et al %	3	3	1		
		43%	43%	14%		
	Current study %	2	0	2	3	1
		25.0 %	0.0%	25.0 %	37.5 %	12.5%
GBM	Arash devgan et al %	8	7	1	1	0
		47%	41%	.05%	.05%	0
	Current study %	7	4	8	0	0
		36.8 %	21.1 %	42.1 %	0.0%	0.0%

Comparision of histopathological parameters (Cellularity, Nuclear pleomorphism, Mitosis, Vascular proliferation and necrosis) with CD117 expression.

In our study those cases which had high cellularity had highest percentage positivity(69.6%).The cases with low cellularity showed nil positivity. This study is statistically significant.P < 0.041.

In our study there was significant correlation found between nuclear pleomorphism and CD117 expression.The cells with marked nuclear pleomorphism showed increased CD117 expression P<0.042.

Correlation of CD117 with mitoses ,vascular proliferation and necroses showed no statsitical significance. There are no studies in literature to support CD117 expression with histological parameters.

There are no studies to compare the Histological parameters with CD117 expression in literature.

Comparison of CD117 with Age, Sex and Side

Comparison of CD117 with age shows highest CD117 positivity in age group of 61-80 years age.

On Comparing CD117 with sex, among the CD117 positive cases percentage positivity in females was high (56.2 %) when compared to males (52.9%) .

Comparision of CD117 with side of gliomas shows highest percentage of CD117 positivity in left hemisphere (64.7%) Right hemisphere show 50% positivity. Deep seated midline structures show 44.4% positivity. There are no studies to correlate CD117 positivity with age, sex and side of the lesion.

STRENGTH AND LIMITATIONS OF THIS STUDY:

STRENGTH OF THIS STUDY:

1. Study covers a period of 2 years done at a tertiary care hospital in south India.

2. The clinicopathological aspects of glioma- their relative incidence, age distribution, sex predeliction, site involvement has been enumerated and will be of value in estimating the same for a ftrure population based study.

3. the strong association of CD117 expression in various grades of glioma, with the maximum intensity seen in grade III glioma has been shown by our study.

LIMITATIONS OF THIS STUDY:

1. Study is hospital based, hence does not reflect the true incidence and prevalence in the community.

2. Due to economic constraints, the entire cases could not be evaluated with immunohistochemistry.

3. Follow up was not available .

SUMMARY

SUMMARY

- In the present study, histomorphological analysis was done for 263 cases of glioma while immunohistochemical evaluation was done for a subset of 50 cases .CD 117 expression was assessed in these cases.
- The peak incidence of glioma was seen in 41-60 years , while least incidence of glioma was seen in age group more than 80 years.
- 41-60 years is the most common age group affected by glioma.
- The median age at diagnosis in males was 40 years,and 37 years in females
- Gliomas show a male preponderance. Total number of gliomas in males was 168cases(63.9%) and in females was 95 cases(36.1%)
- Glioblastoma multiforme was the most common glioma in our institute and Pilocytic astrocytoma was the second most common glioma .
- Right hemisphere of brain was most commonly involved than left.
- The cerebrum is most commonly involved by the glioma, of which frontal lobe is the most common site .
- Most of the Glioma are WHO grade II followed by WHO grade IV tumours
- WHO grade 1 tumour were more common in age group of less than 20 years. WHO grade II was most common in age group of 21-40 years . WHO grade III and IV tumours were common in the age group above 60 years

- CD117 was positive in 54% of total cases.
- CD117 was positive in 39.13 % 0f low grade tumours and 66.8% 0f high grade tumours.(p value <0.05)
- Highest CD117 score was seen in WHO grade III tumours with P value of 0.011.
- The cells with marked nuclear pleomorphism showed increased CD117 expression which wass statisticaly significant.(P< 0.042)
- On correlating CD117 expression with cellularity, those cases which had high cellularity showed highest percentage of positivity which was statistically significant.P < 0.041
- Highest CD117 positivity was seen in 61-80 years age group followed by 41-60 years.
- Females show maximum CD117 positivity with 56.2% and males show 52.9% positivity
- Highest percentage of CD117 positivity is seen in Left hemisphere tumours(64.7%). Right hemisphere tumours show 50% positivity. Tumours in the deep seated midline structures show 44.4% positivity.

CONCLUSION

CONCLUSION

Incidence of gliomas are on the rise .Brain tumours are different from other tumours, as prognosis depends on the site of the tumour and most tumours are less amenable for surgery. In our study, CD117 is expressed remarkably in high grade tumours than in low grade tumours. Hence CD117 can be used as a perfect tool to identify these tumours and thus make them amenable to chemo therapy with tyrosine kinase inhibitors like Imatinib, which is already proven and in vogue in gastrointestinal stromal tumour.

This study opens the vision on targeted therapy in gliomas of high grade.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Kurland, L.T., Schoenberg, B.S., Annegers, J.F., Molgaad, C.Aand Okazaki, H.(1982) The incidence of primary intracranialneoplasms in Rochester, Minnesota 1935–1977. Ann. N. Y. Acad.Sci. 381, 6–16.
2. Ries, L.A.G., Kosary, C.L., Hankey, B.F., Edwards and Miller,B.A B.K. (Eds.) (1998) SEER Cancer statistics review 1973–1995(preliminary edition)Faith G. Davis, Bridget J. McCarthy and Mitchel S. Berger(1999)
3. Balkrishna B Yeole: Trends in the Brain Cancer Incidence in India ; Asian Pacific Journal of Cancer Prevention, Vol 9, 2008
4. Russell DS ,Rubinstein Lj: pathology of tumors of nervous system Baltimore,Williams&Wilkins1989
5. Kleihaur P Cavane W (eds):Pathology and genetics of tumours of nervous system.world health organisation classification of tumors ,Lyon,France,IARC Press 2000.
6. Burger P Scheithauer B Vogel F : surgical pathology of nervous system and its coverings ,Newyork,Churchilllivingstone ,2002
7. Lantos P et al Tumors of the nervous system,In Graham D ,Lantos P (eds) Greenfields Neuropathology London ,Arnold 2002.p 767
8. Ironoside J et al : Diagnostic pathology of nervous system tumours London churchillivingstone 2002
9. Bigner D McLendonR ,Bruner J (eds):Russell and Rubinsteins Pathology of tumors of nervous system Arnold, London ,1998.
10. Louis D N ohgaki H ,Wiestler O D et al 2007 WHO classification of central nervous system.IARC Press Lyon ,France
11. Sanai, N., A. Alvarez-Buylla, et al. (2005). "Neural stem cells and the origin of gliomas." N Engl J Med 353(8): 811-22.
12. TabatabaiG Weller M 2011 Glioblstoma stem cells Cell Tissue Res 343; 459-165
13. Renan, M. J. (1993). "How many mutations are required for tumorigenesis? Implications from human cancer data." MolCarcinog 7(3): 139-46.

14. Quinones-Hinojosa A,Sanai N ,Soriano –Navaro M et al 2006 cellular composition and cytoarchitecture of the adult subventricular zone : a niche of neural stem cells .J comp Neurol 494: 415-434

15. Kukekov V G ,Laywell E D ,Suslov O et al,1999,Multipotent stem/progenitor cells with similar properties arise from two neurogenic regions of adult human brain .ExpNeurol 156: 333-344

16. Bernier P J Vinet J ,Cossette M et al .2000.Characteristics of subventricular zone of adult human brain: evidence for involvement of Bcl 2

17. Lin D A ,Cha S, Mayo M c et al .2007 Relationship of glioblastomamultiforme neural stem cell regions predicts invasive and multifocal tumor phenotype Neurooncol 9 : 424-429

18. J Korean Neurosurg Soc. 2010 Aug; 48(2): 145–152. Epidemiology of Primary Brain and Central Nervous System Tumors in KoreaChang-Hyun Lee, ., Kyu-Won Jung, Heon Yoo,.,[3] Sohee Park, and SeungHoon Lee

19. Descriptive epidemiology of primary brain and CNS tumors: Results from the Central Brain Tumor Registry of the United States, 1990–19941 Tanya S. Surawicz2 , Bridget J. McCarthy, VarantKupelian, Patti J. Jukich, Janet M. Bruner, Faith G. Davis, and the collaborating registries of the Central Brain Tumor Registry of the United States Division of Epidemiology and Biostatistics [T.S.S., B.J.M., V.K., P.J.J., F.G.D.], School of Public Health, University of Illinois at Chicago, IL 60612; and Department of Pathology [J.M.B.], M.D. Anderson Cancer Center, University of Texas, Houston, TX 77030-4095

20. Epidemiology of Brain TumorsRanda El-Zein, Ann Yuriko Minn, Margaret Wrensch, and Melissa l. Bondy

21. Reynolds, B.A. and Weiss, S., Generation of neurons and astrocytes from isolated cells of the adult mammalian central nervous system [see comments]. Science, 255, 1707-10 (1992)

22. Goldman, J., E., Developmental origins of astrocytes. In: K. Jessen, R. and Richardson, W., D. (ed.), Glial Cell Development, The molecular and cellular neurobiology series, pp. 31-47, BIOS Scientific Publishers Ltd, Oxford (1996)

23. Cancer in India: Prevalence, Management and Outcome Prospects for Research SubrataSinha Department of Biochemistry All India Institute of Medical Sciences New Delhi.

24. Paterson, J.A., Privat, A., Ling, E.A. and Leblond, C.P., Investigation of glial cells in semithin sections. 3.Transformation of subependymal cells into glial cells, as shown by radioautography after 3 H-thymidine injection into the lateral ventricle of the brain of young rats. J Comp Neurol, 149, 83-102 (1973).

25. A and Mats.Rutka, J.T., Murakami, M., Dirks, P.B., Hubbard, S.L., Becker, L.E., Fukuyama, K., Jung, S., Tsuguuzawa, K., Role of glial filaments in cells and tumors of glial origin: a review. J Neurosurg, 87, 420-30 (1997).

26. Johansson, C.B., Momma, S., Clarke, D.L., Risling, M., Lendahl, U. and Frisen, J., Identification of a neural stem cell in the adult mammalian central nervous system. Cell, 96, 25-34 (1999).

27. In: Louis DN, Ohagi H, Wiestler OD, Cavenne WK, ed. WHO classification of tumours of the central nervous system, Lyon: IARC; 2007:25-49

28. OhghakiH ,Kleihauser P 2005 population based studies on incidence survival rates and genetic alterations in astrocytic and oligodendroglialgliomas.J N europatholExpNeurol 479-489.

29. Central Brain Tumor Registry of the United States (2006). http://www.cbtrus.org.

30. A. Ohgaki H, Kleihues P (2007). Genetic pathways to primary and secondary glioblastoma. Am J Pathol 170: 1445-1453

31. Kepes JJ Rubinstein LJ ,Eng Lf 1979 pleomorphic xanthoastrocytomaadistinctivemeningocerebralglioma of young subjects with a relatively favorable prognosis :1839-1852

32. Russell DS ,Rubinstein Lj: pathology of tumors of nervous system 5th ed Edward Arnold London 95-112

33. Ohgaki H, Dessen P, Jourde B, Horstmann S, Nishikawa T, Di Patre PL,Burkhard C, Schuler D, Probst-Hensch NM, Maiorka PC, Baeza N, Pisani P, Yonekawa Y, Yasargil MG, Lutolf UM, Kleihues P (2004). Genetic

pathways to glioblastoma: a population-based study. Cancer Res 64: 6892-6899.

34. Kleihauser P Burger P C A ldapek K D et al 2007 Glioblastoma In: Louis DN, Ohagi H, Wiestler OD, Cavenne WK, ed. WHO classification of tumours of the central nervous system, Lyon: IARC; 2007:33-49

35. Sarkar C, Sharma MC, Sudha K, Gaikwad S, Varma A (1997). A clinico-pathological study of 29 cases of gliosarcoma with special reference to two unique variants. Indian J Med Res 106:229-35: 229-235.

36. Meis JM, Martz KL, Nelson JS (1991). Mixed glioblastomamultiforme and sarcoma. A clinicopathologic study of 26 radiation therapyoncology group cases. Cancer 67: 2342-2349.

37. Morantz RA, Feigin I, Ransohoff J, III (1976). Clinical and pathological study of 24 cases of gliosarcoma. J Neurosurg 45: 398-408

38. Feigin I, Ransohoff J, Lieberman A (1976). Sarcoma arising in oligodendroglioma of the brain. J NeuropatholExpNeurol 35: 679-684.

39. Jennings MT, Frenchman M, Shehab T, Johnson MD, Creasy J, LaPorte K, Dettbarn WD (1995). Gliomatosiscerebri presenting as intractable epilepsy during early childhood. J Child Neurol 10: 37-45

40. Central Brain Tumor Registry of the United States (2012)statistical report on primary brain tumours in united states 2004-2008. http://www.cbtrus.org

41. OhghakiH ,Kleihauser P 2005 population based studies on incidence survival rates and genetic alterations in astrocytic and oligodendroglialgliomas.J N europatholExpNeurol 479-489.

42. Refeinberg G Krosj M Louis D N et al anaplastic oligodendroglioma. In: Louis DN, Ohagi H, Wiestler OD, Cavenne WK, ed. WHO classification of tumours of the central nervous system, Lyon: IARC; 2007:33-49

43. Kim S H 2005 clinical histological and immunohistochemical features 1p/19q loss of heterozygosity in oligodendroglialtumors.

44. Schiffer D (1997). Brain Tumors. Biology, Pathology, and Clinical References. Springer: Berlin.

45. Carter M Nicholson J, Ross et al 2002 genetic abnormalities detected in ependymomas by comparative genomic hybridization.

46. Schiffer D, Chio A, Giordana MT, Migheli A, Palma L, Pollo B, Soffietti R, Tribolo A (1991). Histologic prognostic factors in ependymoma. Childs NervSyst 7: 177-182

47. Kurt E, Zheng PP, Hop WC, van der WM, Bol M, van den Bent MJ, Avezaat CJ, Kros JM (2006). Identification of relevant prognostic histopathologic features in 69 intracranial ependymomas, excluding myxopapillary ependymomas and subependymomas. Cancer 106: 388-395.

48. Malmer B, Haraldsson S, Einarsdottir E, Lindgren P, Holmberg D. Homozygosity mapping of familial glioma in Northern Sweden. Acta Oncol2005;44 (2):114-9.

49. Malmer B, Henriksson R, Gronberg H. Different aetiology of familial low-grade and high-grade glioma? A nationwide cohort study of familial glioma. Neuroepidemiology2002 Nov-Dec;21(6):279-86.

50. Malmer B, Adatto P, Armstrong G, Barnholtz-Sloan J, Bernstein JL, Claus E, et al. GLIOGENE an International Consortium to Understand Familial Glioma. Cancer Epidemiol Biomarkers Prev2007 Sep;16(9):1730-4.

51. Del Valle L, Gordon J, Assimakopoulou M, Enam S, Geddes JF, Varakis JN, et al. Detection of JC virus DNA sequences and expression of the viral regulatory protein T-antigen in tumors of the central nervous system. Cancer Res2001 May 15;61(10):4287-93.

52. Huang H, Reis R, Yonekawa Y, Lopes JM, Kleihues P, Ohgaki H. Identification in human brain tumors of DNA sequences specific for SV40 large T antigen. Brain Pathol1999 Jan;9(1):33-42.

53. Cobbs CS, Harkins L, Samanta M, Gillespie GY, Bharara S, King PH, et al. Human cytomegalovirus infection and expression in human malignant glioma. Cancer Res2002 Jun 15;62(12):3347-50.

54. Cobbs CS, Soroceanu L, Denham S, Zhang W, Britt WJ, Pieper R, et al. Human cytomegalovirus induces cellular tyrosine kinase signaling and promotes glioma cell invasiveness. J Neurooncol2007 Dec;85(3):271-80.

55. Scheurer ME, Bondy ML, Aldape KD, Albrecht T, El-Zein R. Detection of human cytomegalovirus in different histological types of gliomas. Acta Neuropathol2008 Jul;116(1):79-86.

56. Sabatier J, Uro-Coste E, Pommepuy I, Labrousse F, Allart S, Tremoulet M, et al. Detection of human cytomegalovirus genome and gene products in central nervous system tumours. Br J Cancer2005 Feb 28;92(4):747-50.

57. Lau SK, Chen YY, Chen WG, Diamond DJ, Mamelak AN, Zaia JA, et al. Lack of association of cytomegalovirus with human brain tumors. Mod Pathol2005 Jun;18 (6):838-43.

58. Cobbs CS, Soroceanu L, Denham S, Zhang W, Kraus MH. Modulation of oncogenic phenotype in human glioma cells by cytomegalovirus IE1-mediated mitogenicity. Cancer Res2008 Feb 1;68(3):724-30.

59. Louis DN, von Deimling A. Hereditary tumor syndromes of the nervous system: overview and rare syndromes. Brain Pathol1995 Apr;5(2):145-51.

60. Melean G, Sestini R, Ammannati F, Papi L. Genetic insights into familial tumors of the nervous system. Am J Med Genet C Semin Med Genet2004 Aug 15;129C (1):74-84.

61. Malmer B, Haraldsson S, Einarsdottir E, Lindgren P, Holmberg D. Homozygosity mapping of familial glioma in Northern Sweden. Acta Oncol2005;44(2):114-9.

62. Malmer B, Henriksson R, Gronberg H. Different aetiology of familial low-grade and high-grade glioma? A nationwide cohort study of familial glioma. Neuroepidemiology2002 Nov-Dec;21(6):279-86.

63. Malmer B, Adatto P, Armstrong G, Barnholtz-Sloan J, Bernstein JL, Claus E, et al. GLIOGENE an International Consortium to Understand Familial Glioma. Cancer Epidemiol Biomarkers Prev2007 Sep;16(9):1730-4.

64. Craver RD, McGarry P: Delicate longitudinal nuclear grooves in childhood ependymomas. Arch Pathol Lab Med 1994; 118:919-921.

65. Kawano N, Yagishita S, Oka H, Utsuki S, Kobayashi I, Suzuki S, Tachibana S Fujii K: Spinal tanycyticependymomas. ActaNeuropathol 2001; 101:43-48.

66. Fouladi M, Helton K, Dalton J, Gilger E, Gajjar A, Merchant T, Kun L, News ham I, Burger P, Fuller C: Clear cell ependymoma: a clinicopathologic and radiographic analysis of

67. 10 patients. Cancer 2003; 98:2232-2244

68. Min KW, Scheithauer BW: Clear cell ependymoma: a mimic of oligodendroglioma: clinicopathologic and ultrastructural considerations. Am J SurgPathol 1997; 21:820-826

69. Sonneland PR, Scheithauer BW, Onofrio BM: Myxopapillaryependymoma. A clinicopathologic and immunocytochemical study of 77 cases. Cancer 1985; 56:883-893.

70. Helwig EB, Stern JB: Subcutaneous sacrococcygealmyxopapillaryependymoma. A clinicopathologic study of 32 cases. Am J ClinPathol 1984; 81:156-161.

71. Tomatis L, Aitio A, Day NE, et al (1990). Cancer: Causes,Occurrence and Control, International Agency for Researchon Cancer, Publication No. 100, Lyon, France, pp 79-81.

72. Taratuto A L ,Monges J ,Lylyk P et al 1984 superficial cerebral astrocytomas attached to dura Report of six cases in infants Cancer 54: 2505-2512

73. Vanden Burg S R 1993 Desmoplastic infantile ganglioglioma and desmoplastic cerebral astrocytoma of infancy . Brain Pathol 32: 75-281

74. Ozolek JA, Finkelstein SD, Couce ME (2004). Gliosarcoma with epithelial differentiation: immunohistochemical and molecular characterization. A case report and review of the literature. Mod Pathol 17: 739-745. Neuropathol 94: 369-375.

75. Mork SJ, Rubinstein LJ, Kepes JJ, Perentes E, Uphoff DF (1988). Patterns of epithelial metaplasia in malignant gliomas II. Squamous differentiation of epithelial-like formations in gliosarcomas and glioblastomas. J Neuropath ExpNeurol 47: 101-118.

76. Kepes JJ, Fulling KH, Garcia JH (1982). The clinical significance of “adenoid” formations of neoplastic astrocytes, imitating metastatic carcinoma, in gliosarcomas. A review of five cases. ClinNeuropathol 1: 139-150.

77. Ng HK, Poon WS (1990). Gliosarcoma of the posterior fossa with features of a malignant fibrous histiocytoma. Cancer 65: 1161- 1166.

78. Meis JM, Martz KL, Nelson JS (1991). Mixed glioblastomamultiforme and sarcoma. A clinicopathologic study of 26 radiation therapy oncology group cases. Cancer 67: 2342-2349.

79. Tada T, Katsuyama T, Aoki T (1987). Mixed glioblastoma and sarcoma with osteoidchondral tissue. ClinNeuropathol 6: 160-163

80. Mathews T, Moossy J (1974). Gliomas containing bone and cartilage. J NeuropatholExpNeurol 33: 456-471.

81. Hayashi K, Ohara N, Jeon HJ, Akagi S, Takahashi K, Akagi T, Namba S (1993). Gliosarcoma with features of chondroblastic osteosarcoma. Cancer 72: 850-855.

82. Banerjee AK, Sharma BS, Kak VK, Ghatak NR (1989). Gliosarcoma with cartilage formation. Cancer 63: 518-523

83. Mclendon RE, Wiestler OD, Kros JM, Korshunov A, Ng H-K: Ependymoma and anaplastic ependymoma.In:LouisDN,OhgakiH,WiestlerOD,CaveneeWK,ed. WHO classification of tumours of the central nervoussystem,Lyon:IARC; 2007:74-80.

84. Epstein FJ, Farmer JP, Freed D: Adult intramedullary spinal cord ependymomas: the result of surgery in 38 patients. J Neurosurg 1993; 79:204-209.

85. Little NS, Morgan MK, Eckstein RP: Primary ependymoma of a cranial nerve. Case report. J Neurosurg 1994; 81:792-794.

86. ScheithauerBW,SwearingenB,WhyteET,AuluckPK, Stemmer-RachamimovAO:Ependymoma of the sellaturcica: a variant of pituicytoma. Hum Pathol 2009; 40:435-440

87. Tay A, ScheithauerBW, Cameron JD, Myhre MJ, Boerner MJ: Retinal ependymoma:an immunohistologic and ultrastructural study. Hum Pathol 2009; 40:578-583.

88. Craver RD, McGarry P: Delicate longitudinal nuclear grooves in childhood ependymomas. Arch Pathol Lab Med 1994; 118:919-921.

89. Kawano N, Yagishita S, Oka H, Utsuki S, Kobayashi I, Suzuki S, Tachibana S Fujii K: Spinal tanycyticependymomas. ActaNeuropathol 2001; 101:43-48.

90. Fouladi M, Helton K, Dalton J, Gilger E, Gajjar A, Merchant T, Kun L, News ham I, Burger P, Fuller C: Clear cell ependymoma: a clinicopathologic and radiographic analysis of 10 patients. Cancer 2003; 98:2232-2244

91. Min KW, Scheithauer BW: Clear cell ependymoma: a mimic of oligodendroglioma: clinicopathologic and ultrastructural considerations. Am J SurgPathol 1997; 21:820-826

92. Sonneland PR, Scheithauer BW, Onofrio BM: Myxopapillaryependymoma. A clinicopathologic and immunocytochemical study of 77 cases. Cancer 1985; 56:883-893.

93. Helwig EB, Stern JB: Subcutaneous sacrococcygealmyxopapillaryependymoma. A clinicopathologic study of 32 cases. Am J ClinPathol 1984; 81:156-161.

94. Kline MJ, Kays DW, Rojiani AM: Extradural myxopapillaryependymoma: report of two cases and review of the literature. PediatrPathol Lab Med 1996; 16:813-822.

95. Miralbell R, Louis DN, O'Keeffe D, Rosenberg AE, Suit HD: Metastatic ependymoma of the sacrum. Cancer 1990; 65:2353-2355.

96. Lombardi D, Scheithauer BW, Meyer FB, Forbes GS, Shaw EG, Gibney DJ, Katzmann JA: Symptomatic subependymoma: a clinicopathological and flow cytometric study. J Neurosurg 1991; 75:583-588.

97. Orakcioglu B, Schramm P, Kohlhof P, Aschoff A, Unterberg A, Halatsch ME: Characteristics of thoracolumbar intramedullary subependymomas. J Neurosurg Spine 2009; 10:54

98. Rushing EJ, Cooper PB, Quezado M, Begnami M, Crespo A, Smirniotopoulos JG, Ecklund J, Olsen C, Santi M: Subependymoma revisited: clinicopathological evaluation of 83 cases. J Neurooncol 2007; 85:297-305.

99. Siker ML, Wang M, Porter K, Nelson DF, Curran WJ, Michalski JM, et al. Age as an independent prognostic factor in patients with glioblastoma: a Radiation Therapy Oncology Group and American College of Surgeons National Cancer Data Base comparison. J Neurooncol Aug;104(1):351-6.

100. Curran WJ, Jr., Scott CB, Horton J, Nelson JS, Weinstein AS, Fischbach AJ, et al. Recursive partitioning analysis of prognostic factors in three Radiation Therapy Oncology Group malignant glioma trials. J Natl Cancer Inst1993 May 5;85(9):704-10.

101. Ammirati M, Vick N, Liao YL, Ciric I, Mikhael M. Effect of the extent of surgical resection on survival and quality of life in patients with supratentorialglioblastomas and anaplastic astrocytomas. Neurosurgery1987 Aug;21(2):201-6.

102. Hentschel SJ, Sawaya R. Optimizing outcomes with maximal surgical resection of malignant gliomas. Cancer Control2003 Mar-Apr;10(2):109-14.

103. Esteller M, Garcia-Foncillas J, Andion E, Goodman SN, Hidalgo OF, Vanaclocha V, et al. Inactivation of the DNA-repair gene MGMT and the clinical response of gliomas to alkylating agents. N Engl J Med2000 Nov 9;343(19):1350-4.

104. Hegi ME, Diserens AC, Gorlia T, Hamou MF, de Tribolet N, Weller M, et al. MGMT gene silencing and benefit from temozolomide in glioblastoma. N Engl J Med2005 Mar 10;352(10):997-1003.

105. Vredenburgh JJ, Desjardins A, Herndon JE, 2nd, Marcello J, Reardon DA, Quinn JA, et al. Bevacizumab plus irinotecan in recurrent glioblastomamultiforme. J Clin Oncol2007 Oct 20;25(30):4722-9.

106. Shlomit R, Ayala AG, Michal D, Ninett A, Frida S, Boleslaw G, Gad B, Gideon R, Shlomi C (2000). Gains and losses of DNA sequences in childhood brain tumorsanalyzed by comparative genomic hybridization. CancerGenet Cytogenet 121: 67-72.

107. Sanoudou D, Tingby O, Ferguson- Smith MA, Collins VP, Coleman N (2000). Analysis of pilocytic astrocytoma by comparative genomic hybridization. Br J Cancer 82: 1218-1222.

108. Jones DT, Ichimura K, Liu L, Pearson DM, Plant K, Collins VP (2006). Genomic analysis of pilocyticastrocytomas at 0.97 mb resolution shows an increasing tendency toward chromosomal copy number change with age. J NeuropatholExpNeurol 65: 1049-1058.

109. Polydorides AD, Rosenblum MK, Edgar MA: Metastatic renal cell carcinoma to hemangioblastoma in von Hippel–Lindau disease. Arch Pathol Lab Med 2007; 131:641-645

110. Sawyer JR, Roloson GJ, Chadduck WM, Boop FA (1991). Cytogenetic findings in a pleomorphic xanthoastrocytoma. Cancer Genet Cytogenet 55: 225-230.

111. Sawyer JR, Thomas EL, Roloson GJ, Chadduck WM, Boop FA (1992). Telomeric associations evolving to ring chromosomes in a recurrent pleomorphic xanthoastrocytoma. Cancer Genet Cytogenet 60: 152-157.

112. Gessi M, Giangaspero F, Lauriola L, Gardiman M, Scheithauer BW, Halliday W, Hawkins C, Rosenblum MK, Burger PC, Eberhart CG: Embryonaltumors with abundant neuropil and true rosettes: a distinctive CNS primitive neuroectodermaltumor. Am J SurgPathol 2009; 33:211-217.

113. Wasdahl DA, Scheithauer BW, Andrews BT, Jeffrey RA, Jr. (1994). Cerebellar pleomorphic xanthoastrocytoma: case report. Neurosurgery 35: 947-950.

114. Stander M, Peraud A, Leroch B, Kreth FW (2004). Prognostic impact of TP53 mutation status for adult patients with supratentorial World Health Organization Grade II astrocytoma or oligoastrocytoma: a long-term analysis.Cancer 101: 1028-1035

115. Watanabe K, Sato K, Biernat W, Tachibana O, von Ammon K, Ogata N,Yonekawa Y, Kleihues P, Ohgaki H (1997). Incidence and timing of p53 mutations during astrocytoma progression in patients with multiplebiopsies. Clin Cancer Res 3: 523-530.

116. Ohgaki H, Dessen P, Jourde B, Horstmann S, Nishikawa T, Di Patre PL,Burkhard C, Schuler D, Probst-Hensch NM, Maiorka PC, Baeza N, Pisani P, Yonekawa Y, Yasargil MG, Lutolf UM, Kleihues P (2004). Genetic

pathways to glioblastoma: a population- based study. Cancer Res 64: 6892-6899.

117. Okamoto Y, Di Patre PL, Burkhard C, Horstmann S, Jourde B, Fahey M, Schuler D, Probst-Hensch NM, Yasargil MG, Yonekawa Y, Lutolf UM, Kleihues P, Ohgaki H (2004). Population-based study on incidence, survivalrates, and genetic alterations of low-grade diffuse astrocytomas and oligodendrogliomas. ActaNeuropathol 108: 49-56.

118. von Deimling A, Bender B, Jahnke R, Waha A, Kraus J, Albrecht S, Wellenreuther R, Fassbender F, Nagel J, Menon AG, Louis DN, Lenartz D, Schramm J, Wiestler OD (1994). Loci associated with malignant progression inastrocytomas: a candidate on chromosome 19q1. Cancer Res 54: 1397-1401.

119. Balesaria S, Brock C, Bower M, Clark J, Nicholson SK, Lewis P, de Sanctis S, Evans H, Peterson D, Mendoza N, Glaser MG, NewlandsES, Fisher RA (1999). Loss of chromosome 10 is an independent prognostic factor in high grade gliomas. Br J Cancer 81: 1371-1377.

120. Ichimura K, Schmidt EE, Miyakawa A, Goike HM, Collins VP (1998). Distinct patterns of deletion on 10p and 10q suggest involvement of multiple tumor suppressor genes in the development of astrocyticgliomas of differentmalignancy grades. Genes Chromosomes Cancer 22: 9-15.

121. Davies MP, Gibbs FE, Halliwell N, Joyce KA, Roebuck MM, Rossi ML, Salisbury J, Sibson DR, Tacconi L, Walker C (1999). Mutation in the PTEN/MMAC1 gene in archival low grade and high grade gliomas. Br J Cancer79: 1542-1548.

122. Watanabe K, Peraud A, Gratas C, Wakai S, Kleihues P, Ohgaki H (1998). p53 and PTEN gene mutations in gemistocyticastrocytomas. ActaNeuropathol 95: 559-564.

123. Actor B, Cobbers JM, Buschges R, Wolter M, Knobbe CB, Lichter P, Reifenberger G, Weber RG (2002). Comprehensive analysis of genomic alterations in gliosarcoma and its two tissue components. Genes Chromosomes

124. Reis RM, Konu-Leblebliciogl D, Lopes JM, Kleihues P, Ohgaki H (2000). Genetic profile of the gliosarcoma. Am J Pathol 156: 425-432.

125. Thiel G, Losanowa T, Kintzel D, Nisch G, Martin H, Vorpahl K, Witkowski R (1992). Karyotypes in 90 human gliomas. Cancer Genet Cytogenet 58: 109-120.

126. Hamilton RL, Pollack IF (1997). The molecular biology of ependymomas. Brain Pathol 7: 807-822.

127. Parvin Mahzouni1 and Mohsen Jafari Journal of Research in Medical Sciences : The Official Journal of Isfahan University of Medical Sciences . The study of CD117 expression in glial tumors and its relationship with the tumor-type and grade. Feb 2012; 17(2): 159–163.

128. ArashDehghan, Hosein Mahjoub², AzadehRajeipour Iranian Journal of Pathology Determination of CD117 Expression in Glial Tumors and ItsComparison between High Grade and Low Grade Tumors (2010)5 (3), 109-115

129. Shankarkumar, U., and B. Sridharan. "Glioma Indian Scenario: Is There a Human Leucocyte Antigen Association?" Journal of Natural Science, Biology, and Medicine 2.2 (2011): 205–208. PMC. Web. 11 Sept. 2015.

130. Adult gliomas (astrocytomas and oligodendrogliomas): a guide for patients, their families and carers cancer-oncological society in australia.

131. Gurney J G. Severson R K, Davis S, et al: Incidence of cancer inchildren in the United States. Cancer 75:2186-2195, 1995.)

132. Vovoras, D., Pokhrel, K.P. and Tsokos, C.P. (2014) in SciRes. Open Journal of Epidemiology Epidemiology of Tumors of the Brain and Central Nervous System: Review of Incidence and Patterns among Histological Subtypes , 2014, 4, 224-23

133. Indian Council of Medical Research bulletin Vol. 40, No. 2february 2010

134. Neuro-Oncology 9, 319–325, 2007 Suvi L arjavaara, RiittaMäntylä, TiinaSalminen, HannuHaapasalo, J aniRaitanen,Juha J ääskeläinen, and AnssiAuvinen Incidence of gliomas by anatomic location 319–325, 2007

135. N Cetin, G Dienel, M Gokden, Journal of Neuro oncology. 2005

ANNEXURES

ANNEXURE I

INFORMATION SHEET

- Your sample has been accepted.

  We are conducting a study of expression of CD117 in glial tumors and its role in tumor type and grade. at Institute of Pathology, Madras Medical College & Government General Hospital, Chennai and for that your sample may be valuable to us.

- The purpose of this study is to To study the expression of CD117 in glial tumors. To correlate the percentage of expression ofCD117 with the tumor type and grade .To investigate the expression of CD117 as a potential diagnostic marker and target for therapy.

- We are selecting certain cases and if your sample is found eligible, we may be using your sample to perform immunohistochemistry which in any way do not affect your final report or management.
- The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.
- Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss or benefits to which you are otherwise entitled.
- The results of the special study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

Signature of investigator

Signature of participant

Date:

ஆராய்ச்சி தகவல் தாள்

ஆராய்ச்சி தலைப்பு : மூளையில் ஏற்படும் கிளையோமோ எனப்படும் மூளை கட்டிகளை CD117 எனும் சிறப்பு குறியீடு செய்து ஆய்வு.

ஆய்வாளர் : மரு. **M.** ஜெயநந்தினி
நோய்குறியியல் துறை,
சென்னை மருத்துவக் கல்லூரி,
சென்னை - 600003.

தங்களது மூளை புற்றுநோய் கட்டி (அறுவை சிகிச்சை செய்யப்பட்ட கட்டி) இங்கு பெற்றுக் கொள்ளப்பட்டது.

இராஜீவ் காந்தி அரசு பொது மருத்துவமனைக்கு வரும் நோயாளிகளிடம் இருக்கும் மூளை புற்றுநோய் கட்டிகளைப் பற்றிய ஒரு ஆராய்ச்சி இங்கு நடைபெற்று வருகின்றது.

இந்த மூளை கட்டிகள் இக்குறியீடு காண்பித்தால் அதிக வீரியம் உள்ளவை என்னும், இவை டார்கெட் தெரபி எனும் Tyrosine Kinase Inhibitor - Imatinib எனும் மருந்தின் மூலம் இந்த கட்டிகளின் வீரியத்தை கட்டுப்படுத்தலாம். இவையே எனது ஆய்வின் நோக்கமாகும்.

நீங்களும் இந்த ஆராய்ச்சியில் பங்கேற்க நாங்கள் விரும்புகிறோம். இந்த ஆராய்ச்சியில் உங்களுடைய திசுக்களை எடுத்து சில சிறப்புப் பரிசோதனைக்கு உட்படுத்தி அதன் தகவல்களை ஆராய்வோம். அதனால் தங்களது நோயின் ஆய்வறிக்கையோ அல்லது சிகிச்சையோ பாதிப்புக்குள்ளாகாது என்பதையும் தெரிவித்துக் கொள்கிறோம்.

முடிவுகளை அல்லது கருத்துகளை வெளியிடும் போதோ அல்லது ஆராய்ச்சியின் போதோ தங்களது பெயரையோ அல்லது அடையாளங்களையோ வெளியிட மாட்டோம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த ஆராய்ச்சியில் பங்கேற்பது தங்களுடைய விருப்பத்தின் பேரில் தான் இருக்கிறது. மேலும் நீங்கள் எந்நேரமும் இந்த ஆராய்ச்சியில் இருந்து பின்வாங்கலாம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த சிறப்புப் பரிசோதனைகளின் முடிவுகளை ஆராய்ச்சியின் போது அல்லது ஆராய்ச்சியின் முடிவின் போது தங்களுக்கு அறிவிப்போம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த ஆய்வை பற்றிய சந்தேகங்களுக்கு தொடர்பு கொள்ள வேண்டியவர் : மரு. **M.**ஜெயநந்தினி. செல் : 9841021564

பங்கேற்பாளர் கையொப்பம்..... இடம் :..... தேதி :.....

பங்கேற்பாளர் பெயர் மற்றும் விலாசம் .....

ஆராய்ச்சியாளர் கையொப்பம்..... இடம் :..... தேதி :.....

Name and address of the sponsor / agency (ies) (if any) :

Documentation of the informed consent

I _____ have read the information in this form (or it has been read to me). I was free to ask any questions and they have been answered. I am over 18 years of age and, exercising my free power of choice, hereby give my consent to be included as a participant in "" A study of expression of CD117 in GLIAL TUMOURS and its role in tumour type and grade.

1. I have read and understood this consent form and the information provided to me.
2. I have had the consent document explained to me.
3. I have been explained about the nature of the study in which the biopsies collected from neoplastic lesions of brain will be subjected to H&E, and IHC for CD117 expression
4. I have been explained about my rights and responsibilities by the investigator. I have the right to withdraw from the study at any time.
5. I have been informed the investigator of all the treatments I am taking or have taken in the past _____ months including any native (alternative) treatment.
6. I hereby give permission to the investigators to release the information obtained from me as result of participation in this study to the sponsors, regulatory authorities, Govt. agencies, and IEC. I understand that they are publicly presented.
7. I have understand that my identity will be kept confidential if my data are publicly presented
8. I have had my questions answered to my satisfaction.
9. I have decided to be in the research study.

I am aware that if I have any question during this study, I should contact the investigator. By signing this consent form I attest that the information given in this document has been clearly explained to me and understood by me, I will be given a copy of this consent document.

For adult participants:

Name and signature / thumb impression of the participant (or legal representative if participant incompetent)

Name _____ Signature_____ Date_____

Name and Signature of impartial witness (required for illiterate patients):

Name _____ Signature_____ Date_____

Address and contact number of the impartial witness:

Name and Signature of the investigator or his representative obtaining consent:

Name _____ Signature_____ Date_____

ஆராய்ச்சி ஒப்புதல் கடிதம்

ஆராய்ச்சி தலைப்பு : **மூளையில் ஏற்படும் கிளையோமோ எனப்படும் மூளை கட்டிகளை CD117 எனும் சிறப்பு குறியீடு செய்து ஆய்வு.**

சென்னை மருத்துவக் கல்லூரி நோய்குறியியல் துறையில் பயிலும் முதுகலை மருத்துவர் M. ஜெயநந்தினி, அவர்கள் மேற்கொள்ளும் இந்த ஆய்வில் பங்குகொள்ள ..... ஆகிய நான் முழு மனதுடன் சம்மதிக்கிறேன்.

எனக்கு விளக்கப்பட்ட விஷயங்களை நான் புரிந்து கொண்டு நான் எனது சம்மதத்தைத் தெரிவிக்கிறேன்.

இந்த ஆராய்ச்சியில் பிறரின் நிர்ப்பந்தமின்றி என் சொந்த விருப்பத்தின் பேரில் தான் பங்கு பெறுகிறேன் மற்றும் நான் இந்த ஆராய்ச்சியிலிருந்து எந்நேரமும் பின்வாங்கலாம் என்பதையும் அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் நான் புரிந்து கொண்டேன்.

நான் மூளை புற்றுநோய் கட்டி நோய்கள் குறித்த இந்த ஆராய்ச்சியின் விவரங்களைக் கொண்ட தகவல் தாளைப் பெற்றுக் கொண்டேன்.

நான் என்னுடைய சுயநினைவுடன் மற்றும் முழு சுதந்திரத்துடன் இந்த மருத்துவ ஆராய்ச்சியில் என்னை சேர்த்துக் கொள்ள சம்மதிக்கிறேன்.

எனக்கு அறுவை சிகிச்சை செய்யப்பட்டு நோய்க்குறியியல் துறையில் சதைப் பரிசோதனைக்கு பயன்பட்ட மெழுகுக்கட்டிகளை வைத்து ஆராய்ச்சி மற்றும் சிறப்புப் பரிசோதனை செய்யது கொள்ள சம்மதம் தெரிவிக்கிறேன்.

பங்கேற்பாளர் கையொப்பம்..... இடம் :..... தேதி :.....

பங்கேற்பாளர் பெயர் மற்றும் விலாசம் .....

ஆராய்ச்சியாளர் கையொப்பம்..... இடம் :..... தேதி :.....

ANNEXURE II

PROFORMA

Case no : OP/IP NO :

Name : Biopsy No :

Age :

Sex :

Clinical diagnosis :

Symptoms :

H/O Recurrence :

Risk factors any :

CT/MRI findings :

Site : Contrast enhancement :

Side : Ventricle obstruction :

Solid : Cystic with mural nodule :

Cystic :

Type of surgery :

Gross :

Size:

Papillary excrescence:

Necrosis:

Microscopy :

Cellularity 1-low 2-moderate 3- high

Nuclear pleomorphism 1+ mild 2+ marked

Mitoses A-absent P- present

Vascular proliferation absent/present

Necroses absent/present

Histological typing :

WHO grading:

Grade I Grade III

Grade II Grade IV

IHC RESULTS : CD117 1.Positivity &

2. Semi quantitative Score (1-4+)

3.Staining intensity weak

Moderate

strong

CD117 :

ANNEXURE II

WHO grades of CNS tumours

	I	II	III	IV
Astrocytic tumours				
Subependymal giant cell astrocytoma	•			
Pilocytic astrocytoma	•			
Pilomyxoid astrocytoma		•		
Diffuse astrocytoma		•		
Pleomorphic xanthoastrocytoma		•		
Anaplastic astrocytoma			•	
Glioblastoma				•
Giant cell glioblastoma				•
Gliosarcoma				•
Oligodendroglial tumours				
Oligodendroglioma		•		
Anaplastic oligodendroglioma			•	
Oligoastrocytic tumours				
Oligoastrocytoma		•		
Anaplastic oligoastrocytoma			•	
Ependymal tumours				
Subependymoma	•			
Myxopapillary ependymoma	•			
Ependymoma		•		
Anaplastic ependymoma			•	
Choroid plexus tumours				
Choroid plexus papilloma	•			
Atypical choroid plexus papilloma		•		
Choroid plexus carcinoma			•	
Other neuroepithelial tumours				
Angiocentric glioma	•			
Chordoid glioma of the third ventricle		•		
Neuronal and mixed neuronal-glial tumours				
Gangliocytoma	•			
Ganglioglioma	•			
Anaplastic ganglioglioma			•	
Desmoplastic infantile astrocytoma and ganglioglioma	•			
Dysembryoplastic neuroepithelial tumour	•			

	I	II	III	IV
Central neurocytoma		•		
Extraventricular neurocytoma		•		
Cerebellar liponeurocytoma		•		
Paraganglioma of the spinal cord	•			
Papillary glioneuronal tumour	•			
Rosette-forming glioneuronal tumour of the fourth ventricle	•			
Pineal tumours				
Pineocytoma	•			
Pineal parenchymal tumour of intermediate differentiation		•	•	
Pineoblastoma				•
Papillary tumour of the pineal region		•	•	
Embryonal tumours				
Medulloblastoma				•
CNS primitive neuroectodermal tumour (PNET)				•
Atypical teratoid / rhabdoid tumour				•
Tumours of the cranial and paraspinal nerves				
Schwannoma	•			
Neurofibroma	•			
Perineurioma	•	•	•	
Malignant peripheral nerve sheath tumour (MPNST)		•	•	•
Meningeal tumours				
Meningioma	•			
Atypical meningioma		•		
Anaplastic / malignant meningioma			•	
Haemangiopericytoma		•		
Anaplastic haemangiopericytoma			•	
Haemangioblastoma	•			
Tumours of the sellar region				
Craniopharyngioma	•			
Granular cell tumour of the neurohypophysis	•			
Pituicytoma	•			
Spindle cell oncocytoma of the adenohypophysis	•			

ANNEXURE IV

WHO CLASSIFICATION OF CNS TUMOURS

WHO Classification of Tumours of the Nervous System

TUMOURS OF NEUROEPITHELIAL TISSUE

Astrocytic tumours	
Pilocytic astrocytoma	9421/1[1]
Pilomyxoid astrocytoma	*9425/3**
Subependymal giant cell astrocytoma	9384/1
Pleomorphic xanthoastrocytoma	9424/3
Diffuse astrocytoma	9400/3
Fibrillary astrocytoma	9420/3
Gemistocytic astrocytoma	9411/3
Protoplasmic astrocytoma	9410/3
Anaplastic astrocytoma	9401/3
Glioblastoma	9440/3
Giant cell glioblastoma	9441/3
Gliosarcoma	9442/3
Gliomatosis cerebri	9381/3
Oligodendroglial tumours	
Oligodendroglioma	9450/3
Anaplastic oligodendroglioma	9451/3
Oligoastrocytic tumours	
Oligoastrocytoma	9382/3
Anaplastic oligoastrocytoma	9382/3
Ependymal tumours	
Subependymoma	9383/1
Myxopapillary ependymoma	9394/1
Ependymoma	9391/3
Cellular	9391/3
Papillary	9393/3
Clear cell	9391/3
Tanycytic	9391/3
Anaplastic ependymoma	9392/3
Choroid plexus tumours	
Choroid plexus papilloma	9390/0
Atypical choroid plexus papilloma	*9390/1**
Choroid plexus carcinoma	9390/3
Other neuroepithelial tumours	
Astroblastoma	9430/3
Chordoid glioma of the third ventricle	9444/1
Angiocentric glioma	*9431/1**
Neuronal and mixed neuronal-glial tumours	
Dysplastic gangliocytoma of cerebellum (Lhermitte-Duclos)	9493/0
Desmoplastic infantile astrocytoma/ ganglioglioma	9412/1
Dysembryoplastic neuroepithelial tumour	9413/0
Gangliocytoma	9492/0
Ganglioglioma	9505/1
Anaplastic ganglioglioma	9505/3
Central neurocytoma	9506/1
Extraventricular neurocytoma	*9506/1**
Cerebellar liponeurocytoma	*9506/1**
Papillary glioneuronal tumour	*9509/1**
Rosette-forming glioneuronal tumour of the fourth ventricle	*9509/1**
Paraganglioma	8680/1
Tumours of the pineal region	
Pineocytoma	9361/1
Pineal parenchymal tumour of intermediate differentiation	9362/3
Pineoblastoma	9362/3
Papillary tumour of the pineal region	*9395/3**
Embryonal tumours	
Medulloblastoma	9470/3
Desmoplastic/nodular medulloblastoma	9471/3
Medulloblastoma with extensive nodularity	*9471/3**
Anaplastic medulloblastoma	*9474/3**
Large cell medulloblastoma	9474/3
CNS primitive neuroectodermal tumour	9473/3
CNS Neuroblastoma	9500/3
CNS Ganglioneuroblastoma	9490/3
Medulloepithelioma	9501/3
Ependymoblastoma	9392/3
Atypical teratoid / rhabdoid tumour	9508/3

TUMOURS OF CRANIAL AND PARASPINAL NERVES

Schwannoma (neurilemoma, neurinoma)	9560/0
Cellular	9560/0
Plexiform	9560/0
Melanotic	9560/0
Neurofibroma	9540/0
Plexiform	9550/0

[1] Morphology code of the International Classification of Diseases for Oncology (ICD-O) {614A} and the Systematized Nomenclature of Medicine (http://snomed.org). Behaviour is coded /0 for benign tumours, /3 for malignant tumours and /1 for borderline or uncertain behaviour.

* The italicised numbers are provisional codes proposed for the 4th edition of ICD-O. While they are expected to be incorporated into the next ICD-O edition, they currently remain subject to change.

Perineurioma	
Perineurioma, NOS	9571/0
Malignant perineurioma	9571/3
Malignant peripheral nerve sheath tumour (MPNST)	
Epithelioid MPNST	9540/3
MPNST with mesenchymal differentiation	9540/3
Melanotic MPNST	9540/3
MPNST with glandular differentiation	9540/3

TUMOURS OF THE MENINGES

Tumours of meningothelial cells

Meningioma	9530/0
Meningothelial	9531/0
Fibrous (fibroblastic)	9532/0
Transitional (mixed)	9537/0
Psammomatous	9533/0
Angiomatous	9534/0
Microcystic	9530/0
Secretory	9530/0
Lymphoplasmacyte-rich	9530/0
Metaplastic	9530/0
Chordoid	9538/1
Clear cell	9538/1
Atypical	9539/1
Papillary	9538/3
Rhabdoid	9538/3
Anaplastic (malignant)	9530/3

Mesenchymal tumours

Lipoma	8850/0
Angiolipoma	8861/0
Hibernoma	8880/0
Liposarcoma	8850/3
Solitary fibrous tumour	8815/0
Fibrosarcoma	8810/3
Malignant fibrous histiocytoma	8830/3
Leiomyoma	8890/0
Leiomyosarcoma	8890/3
Rhabdomyoma	8900/0
Rhabdomyosarcoma	8900/3
Chondroma	9220/0
Chondrosarcoma	9220/3
Osteoma	9180/0
Osteosarcoma	9180/3
Osteochondroma	9210/0
Haemangioma	9120/0
Epithelioid haemangioendothelioma	9133/1
Haemangiopericytoma	9150/1
Anaplastic haemangiopericytoma	9150/3
Angiosarcoma	9120/3
Kaposi sarcoma	9140/3
Ewing sarcoma - PNET	9364/3

Primary melanocytic lesions

Diffuse melanocytosis	8728/0
Melanocytoma	8728/1
Malignant melanoma	8720/3
Meningeal melanomatosis	8728/3

Other neoplasms related to the meninges

Haemangioblastoma	9161/1

LYMPHOMAS AND HAEMATOPOIETIC NEOPLASMS

Malignant lymphomas	9590/3
Plasmacytoma	9731/3
Granulocytic sarcoma	9930/3

GERM CELL TUMOURS

Germinoma	9064/3
Embryonal carcinoma	9070/3
Yolk sac tumour	9071/3
Choriocarcinoma	9100/3
Teratoma	9080/1
Mature	9080/0
Immature	9080/3
Teratoma with malignant transformation	9084/3
Mixed germ cell tumour	9085/3

TUMOURS OF THE SELLAR REGION

Craniopharyngioma	9350/1
Adamantinomatous	9351/1
Papillary	9352/1
Granular cell tumour	9582/0
Pituicytoma	*9432/1**
Spindle cell oncocytoma of the adenohypophysis	*8291/0**

METASTATIC TUMOURS

ANNEXURE V

Immunohistochemistry procedure:

Slide Preparation:

1. Sections with a thickness of 4 μ were cut from formalin fixed paraffin embedded tissue samples and transferred to gelatin-chrome alum coated slides.
2. The slides were incubated for overnight at 58ºC.
3. The sections were deparaffinised in xylene for 15 minutes x 2 changes.
4. The sections were dehydrated with absolute alcohol for 5 minutes for 2 changes.
5. Then the sections were washed with tap water for 10 minutes.
6. The slides are then immersed in distilled water upto 5 minutes.

Antigen Retrieval:

1. Heat induced antigen retrieval was done with microwave oven in appropriate temperature with appropriate buffer for 20 minutes. This step unmasks the antigenic determinants of fixed tissue sections.
2. The slides were then cooled to room temperature for 20 minutes and washed with tap water for 5 minutes.
3. The slides were then rinsed with distilled water for 5 minutes.
4. then the slides were washed with appropriate wash buffer (phosphate buffer) for 5 minutes x 2 changes.
5. Peroxidase block was then applied for 10 minutes.
6. The slides then were washed in phosphate buffer for 5 minutes x 2 changes.
7. Sections were covered with protein block for 5 minutes.

Antibody application:

1. The sections were drained (without washing) and appropriate primary antibody is applied and incubated for 30 minutes.
2. The slides were washed in the phosphate buffer for 5 minutes x 2 changes.
3. The slides were covered with Primary antibody amplifier for 10 minutes.
4. The slides were washed in the phosphate buffer for 5 minutes x 2 changes.
5. The slides were covered with HRP micropolymerQuanto for 10 minutes.
6. The slides were washed in the phosphate buffer for 5 minutes x 2 changes.

Chromogen application:

1. DAB substrate was prepared by diluting 1 drop of DAB Quantochromogen to 1 ml of DAB Quanto buffer.
2. DAB substrate solution was applied on the sections for 5 minutes.
3. wash the slides then in distilled water for 2 minutes.
4. counterstain the section with Hematoxylin for 2 seconds.
5. wash the slides in running tap water for 5 minutes.
6. air dry the slides, cleared with xylene and mounted with DPX.

Alternate methods of antigen retrieval

- Pressure cooker antigen retrieval
- Microwave and trypsin antigen retrieval

MASTER CHART-statistics for two years fromjan 2013 to dec 2014

S.NO	NP NO	AGE	SEX	SIDE	site	RADIOLOGY	SQUASH	HPE							DIAGNOSIS	GRADE	IHC		
								CELLULARITY	NP	MITOSES	VP	NEC	CA	OTHERS			CD117%	CD117-IN	SCORE
1	/1/13	45	M	L	FT	GBM	HGG	3	PP	P		P			GBM	4			
2	3/13	46	M	L	FT	GBM	HGG	2	PP	P	P	P			GBM	4			
3	4/13	51	M	L	P	BRAIN ABCESS	HGG	2	PP	P	P	P			GBM	4			
4	5/13	51	M	R	F	LGG	HGG	1	P	P	A	A			DFA	2			
5	6/13	37	F	L	F	HGG	HGG	3	PP	PP	P	A			AA	3			
6	11/13	35	M	L	F	CCG	HGG	2	P	P	P	P			GBM	4			
7	12/13	60	M	L	P	CYSTIC SOL	HGG	2	PP	P	P	P			GBM	4			
8	14/13	63	M	R	TP	HGG	HGG	3	PP	P	P	P		GIANT CELL RICH	GBM	4			
9	18/13	50	M	R	F	LGG	LGG	2	P	A	A	A			DA	2			
10	19/13	67	M	L	TP	HGG	HGG	2	PP	P	P	P			GBM	4			
11	21/13	83	M	L	TP	HGG	HGG	2	PP	P	P	P			GBM	4			
12	26/13	4	M	M	PO FO	EP	LGG	2	P	P	A	A			EP	2			
13	28/13	56	M	R	TP	HGG	HGG	2	P	P	A	A			GBM	4			
14	31/13	35	M	M	FP	HGG	HGG	2	P	A	A	A	P		DFA	2			
15	33/13	14/M	M	SC	IMSOL	ASTROCYTOMA	LGG	2	P	A	A	A			PA	1			
16	34/13	18	M	SC	IMSOL	LGG	EP	2	P	P	A	A			DA	2			
17	36/13	22	M	R	FP	LGG	PA	2	P	A	A	A			PA	1			
18	37/13	60	F	R	TP	HGG	GBM	3	PP	P	P	P			GBM	4			
19	38/13	2	F	M	PF	LGG	EP	2	PP	P	A	A		CLEAR CELL	EP	2			
20	43/13	22	M	M	CEREBELLUM	REC ASTRO	LGG	2	P	A	A	A			PA	1			
21	44/13	27	F	M	BG	HGG	HGG	2	P	A	A	A			GBM	4			
22	46/13	35	M	R	FT	LGG	LGG	1	P	P	A	A			DA	2			
23	56/13	35	m	R	TP	HGG	HGG	3	PP	P	P	P		ODG DIFF	GBM	4			
24	63/13	1	MCH	M	PF	MEDUL	PA	2	P	P	A	A			EP	2	NEG		0+
25	68/13	50	M	L	FTP	HGG	HGG	2	P	A	A	A			PA	1			
26	69/13	12	MCH	R	FTP	PNET	PA	2	P	A	A	A			PA	1	POS	WEAK	2+
27	88/13	40	F	R	P	ABCESS	HGG	2	PP	P	P	P			GBM	4	NEG		0+
28	94/13	37	M	R	F	LGG	HGG	3	PP	P	P	A			AA	3			

S.NO	NP NO	AGE	SEX	SIDE	site	RADIOLOGY	SQUASH	HPE							DIAGNOSIS	GRADE	IHC		
								CELLULARITY	NP	MITOSES	VP	NEC	CA	OTHERS			CD117%	CD117-IN	SCORE
29	96/13	60	F	L	P	HGG	HGG	3	PP	P	P	P			GBM	4	POS	MOD	2+
30	104/13	10	F	R	T	HGG	C EP	3	PP	P	P	P			AEP	3			
31	105/13	65	M	L	F	HGG	DFA	3	PP	P	P	A			AOA	3			
32	124/13	34	M	R	FP	LGG	DFA	2	PP	P	A	A			DFA	2			
33	127/13	8	M	R	BG	LGG	LGG	1	P	P	A	A			PA	1			
34	130/13	64	F	L	P	HGG	HGG	3	PP	P	P	P			GBM	4			
35	134/13	67	F	L	PO	HGG	HGG	3	PP	P	P	P			GBM	4			
36	137/13	18	M	R	T	LGG	LGG	1	P	P	A	A			PA	1	NEG		0+
37	140/13	37	M	R	BG	LGG	LGG	1	P	A	A	A			DA	2			
38	143/13	46	M	R	T	HGG	HGG	1	PP	P	P	P			GBM	4			
39	145/13	50	M	L	TP	LGG	LGG	1	PP	P	A	A			PA	1			
40	146/13	68	M	L	T	HGG	HGG	3	PP	P	A	A			GBM	4			
41	147/13	85	M	L	F	HGG	HGG	2	P	P	A	P			AA	3	NEG		0+
42	152/13	30	M	M	BS	LGG	HGG	2	P	P	P	A			AA	3	POS	MOD	3+
43	153/13	47	M	L	FP	HGG	HGG	3	P	P	P	P			GBM	4			
44	154/13	18	M	M	IMSOL	MENINGIOMA	EPEN	3	P	P	A	A			GG	2			
45	156/13	42	M	M	T	GLIOMA	LGG	1	P	A	A	A			DFA	2	NEG		0+
46	159/13	7	M	M	BS	LGG	LGG	1	P	A	A	A			PA	1			
47	164/13	34	F	M	PO FO	EPEN	EPEN	3	P	A	A	A			EP	2			
48	167/13	11	F	R	T	HGG	HGG	3	P	P	P	P		ODG DIFFWITH SMALL CELL	GBM	4			
49	175/13	51	M	R	F	ODG	ODG	3	P	P	A	A	P		ODG	2			
50	176/13	32	F	L	T	DFA	DA	3	P	P	A	A		GEMISTO CYTES	GA	3			
51	185/13	48	F	L	TP	HGG	HGG	3	PP					ODG DIFF	GBM-	4	POS	WEAK	2+
52	189/13	43	M	L	FP	MENINGIOMA	HGG	3	PP	P	P	P			GBM	4			
53	191/13	5	M	M	BS	TB	LGG	2	P	P	A	A			PA	1			
54	192/13	42	M	R	TP	HGG	HGG	3	P	P	P	P			GBM	4	NEG		0+
55	197/13	18	M	M	IMSOL	LGG		2	P	P	P	A	P		GG	2			
56	202/13	30	M	L	TP	HGG	AA	2	P	P	P	A	P		AEP	3			
57	203/13	12	M	R	FTP	HGG	HGG	3	P	P	A	A			PA	1			
58	206/13	45	F	R	FTP	HGG	HGG	3	P	P	P	A			GBM	4			

S.NO	NP NO	AGE	SEX	SIDE	site	RADIOLOGY	SQUASH	HPE							DIAGNOSIS	GRADE	IHC		
								CELLULARITY	NP	MITOSES	VP	NEC	CA	OTHERS			CD117%	CD117-IN	SCORE
59	210/13	53	F	R	P	HGG	HGG	2	P	P	A	A			AA	3			
60	219/13	28	M	R	P	HGG	AE	3	P	P	P	A		GC	GBM	4			
61	226/13	14	M	R	TP	LGG	LGG	3	P	P	P	P			PA	1			
62	228/13	55	F	R	P	HGG	HGG	3	PP	P	P	P			GBM	4			
63	230/13	57	M	R	P	HGG	HGG	3	PP	P	P	P			GBM	4			
64	237/13	28	M	R	ID EM	LGG		2	P	A	A	A			MPEP	1			
65	238/13	52	M	R	FT	HGG	HGG	2	PP	P	P	P			GBM	4			
66	239/13	9	M	M	OC	PIT ADENOMA	LGG	2	P	A	A	A			PA	1			
67	245/13	52	M	M	CCSOL	HGG	HGG	3	PP	P	P	P			GBM	4			
68	247/13	12	F	M	PO FO	MURALNODULE	PA	2	P	A	A	A			PA	1			
69	249/13	13	M	M	PO FO	MURALNODULE	PA	2	P	A	A	A			PA	1	NEG		0+
70	250/13	60	F	R	TP	HGG	HGG	3	PP	P	P	P			GBM	4	POS	WEAK	1+
71	256/13	65	M	R	FP	HGG	HGG	3	PP	P	P	P			GBM	4	POS	WEAK	2+
72	262/13	37	F	R	4TH VEN	LGG	EP	3	PP	A	A	A	CELLULAR	PSAMOMA	EP	2	NEG		0+
73	275/13	48	M	L	T	METS	HGG	3	PP	P	PP	P			GBM	4	POS	MOD	2+
74	279/13	33	M	L	F	LGG	LGG	2	P	P	A	A			DFA	2	NEG		0+
75	281/13	6	M	R	FP	HGG	INADEQUATE	2	PP	P	P	P			GBM	4	NEG		0+
76	283/13	60	F	R	FP	HGG	HGG	3	PP	P	P	P			GBM	4			
77	288/13	38	M	R	T	GLIOMA	AA	3	PP	P	A	A			AA	3			
78	298/13	21	F	L	T	GLIOMA		2	P	A	A	A			GG	2			
79	310/13	31	M	R	TP	GLIOMA		2	P	A	A	A			GG	2			
80	314/13	7	M	M	SS	CP	CP	2	P	A	A	A	P		PA	1			
81	316/13	32	M	L	FTP	HGG	HGG	3	P	P	P	A			AA	3	POS	STRONG	3+
82	321/13	35	M	L	TP	HGG	HGG	2	P	P	P	A			AA	3			
83	322/13	42	M	M	CC SOL	GLIOMA	LGG	2	P	P	A	A			DA	2			
84	324/13	65	F	R	CEREBELLUM	LGG	LGG	3	P	P	A	A			DA	2			
85	334/13	53	F	R	T	HGG	HGG	3	PP	P	P	P			GBM	4			
86	337/13	34	M	R	F	HGG	HGG	3	PP	p	p	A			AA	3			

S.NO	NP NO	AGE	SEX	SIDE	site	RADIOLOGY	SQUASH	HPE							DIAGNOSIS	GRADE	IHC		
								CELLULARITY	NP	MITOSES	VP	NEC	CA	OTHERS			CD117%	CD117-IN	SCORE
87	342/13	46	M	L	F	LGG	LGG	2	P	P	A	A			DFA	2			
88	354/13	42	M	R	T	HGG	HGG	3	PP	P	P	P			GBM	4			
89	359/13	8	MCH	M	PO FO	LGG	LGG	2	P	P	P	A			PA	1			
90	370/13	9	M	M	PO FO	LGG	EP	3	PP	P	P	A		CELLULAR	EP	2			
91	371/13	47	M	L	F	AA	HGG	3	PP	P	P	A		GEMISTOCYTES	AA	3	POS	WEAK	3+
92	372/13	49	M	L	F	GLIOMA	DA	2	P	P	P	P			GBM	4	NEG		0+
93	373/13	44	M	R	FTP	GLIOMA	PA	2	P	P	P	A			DFA	2	NEG		0+
94	390/13	30	F	R	F	LGG	LGG	2	P	P	A	A			DFA	2			
95	393/13	32	F	R	T	LGG	LGG	2	P	P	A	A			DFA	2			
96	394/13	43	F	L	TP	HGG	HGG	3	P	P	P	A			AA	3	NEG		0+
97	397/13	58	M	R	TP	GLIOMA	HGG	3	PP	P	P	A			AA	3			
98	398/13	32	F	M	BS	EPEN	EP	3	P	P	P	A			EP	2			
99	401/13	53	F	R	CEREBELLUM	GLIOMA	LGG	2	PP	P	P	A			EP	2			
100	403/13	34	M	R	TP	GLIOMA	LGG	2	P	P	P	A			DFA	2			
101	405/13	7	F	L	CP ANGLE	GLIOMA	PA	2	P	P	A	A			PA	1			
102	406/13	65	M	L	F	ODG	ODG	2	PP	P	P	P			GBM	4			
103	426/13	55	M	R	F	HGG	HGG	3	PP	P	P	P			GBM	4	POS	WEAK	1+
104	413/13	5 MON	MCH	L	PO	LGG	LGG	2	P	A	A	A		STORIFORM	DES AS	1			
105	430/13	4	F	R	CP ANGLE	MEDULLOBLASTOMA	MEDULLOBLASTOMA	3	P	P	P	A			EP	2			
106	432/13	32	M	L	FT	GLIOMA	ODG	3	P	P	A	A			AA	3			
107	436/13	25	M	R	F	GLIOMA	GLIOMA	2	P	P	P	A			AA	3			
108	437/13	14	M	R	FP	GLIOMA	GLIOMA	2	P	P	A	A			PA	1			
109	438/13	65	M	L	PO	HGG	HGG	3	PP	P	P	P			GBM	4			
110	439/13	50	M	L	T	HGG	HGG	2	PP	P	P	P		SMALL CELL	GBM	4			
111	444/13	35	F	M	CC SOL	HGG	HGG	3	PP	P	P	A			OA	2	POS	WEAK	3+

S.NO	NP NO	AGE	SEX	SIDE	site	RADIOLOGY	SQUASH	HPE							DIAGNOSIS	GRADE	IHC		
								CELLULARITY	NP	MITOSES	VP	NEC	CA	OTHERS			CD117%	CD117-IN	SCORE
112	450/13	44	M	R	F	LGG	LGG	2	P	P	A	A			ODG	2	POS	WEAK	3+
113	451/13	55	F	R	FP	HGG	HGG	3	PP	P	P	P			GBM	4			
114	461/13	45	F	R	FP	LGG	LGG	2	P	P	A	A			DA	2			
115	479/13	1	M	M	IV	EP	EP	2	P	A	P	A			AEP	3			
116	480/13	22	M	M	ID EM	EP	NIL	2	P	P	A	A			MPEP	1			
117	483/13	65	F	R	F	LGG	LGG	2	P	P	A	A			DA	2			
118	487/13	17	M	R	P	LGG	LGG	1	P	A	P	A			DFA	2			
119	489/13	3	F	M	PO FO	MEDULLOBLASTOMA	EPEN	2	P	A	P	A			EP	2			
120	491/13	29	M	M	PO FO	EPEN	EPEN	2	P	P	A	A			EP	2			
121	493/13	29	M	R	F	LGG	LGG	2	P	P	A	A			DFA	2			
122	501/13	60	F	L	TP	GLIOMA	LGG	3	PP	P	PP	P			GBM	4			
123	504/13	70	M	R	FP	HGG	HGG	3	PP	P	P	P			GBM	4			
124	512/13	16	M	R	F	PA	PA	2	P	P	A	A			PA	1	POS	WEAK	2+
125	513/13	37	F	L	F	HGG	HGG	3	PP	P	A	P		GC	GBM	4	POS	WEAK	1+
126	514/13	60	F	M	BG	GLIOMA	HGG	1	PP	P	P	P			GBM	4			
127	518/13	57	M	R	F	HGG	HGG	2	PP	P	P	P			GBM	4			
128	521/13	60	M	M	4TH VEN	GLIOMA	GBM	3	P	P	PP	P			GBM	4			
129	526/13	9	F	M	PO FO	GLIOMA	CELLULAR EPEN	3	P	P	A	A			EP	2			
130	532/13	64	M	R	P	HGG	HGG	3	PP	P	P	P			GBM	4			
131	554/13	37	F	L	F	HGG	HGG	3	PP	PP	PP	P		GC	GBM	4			
132	559/13	56	M	L	TP		HGG	3	PP	PP	P	P		GC	GBM	4			
133	563/13	60	F	L	P		HGG	3	PP	P	PP	P			GBM	4			
134	572/13	26	F	M	IMSOL	SOL	EP	2	P	P	A	A			AEP	3			
135	578/13	36	M	R	FT		LGG	2	P	A	A	A			DFA	2			
136	580/13	19	M	R	BG		GG	2	P					GC	GG	2			
137	586/13	42	M	L	T		MENINGIOMA	3	PP	P	P	P			GBM	2			
138	594/13	56	M	R	BG	GLIOMA	DA	2	P	P	A	A			DFA	2	NEG		0+
139	596/13	15	F	M	PO FO	LGG	LGG	2	P	P	A	A			EP	2			
140	/2/14/	35	M	M	CC SOL	HGG	GBM	2	PP	P	P	A			DFA	2			
141	/7/14	50	M	R	T	GLIOMA	LGG	3	PP	P	P	P			GBM	4	POS	WEAK	2+

S.NO	NP NO	AGE	SEX	SIDE	site	RADIOLOGY	SQUASH	HPE							DIAGNOSIS	GRADE	IHC		
								CELLULARITY	NP	MITOSES	VP	NEC	CA	OTHERS			CD117%	CD117-IN	SCORE
142	/9/14	85	M	L	FT	HGG	HGG	3	PP	P	P	P			GBM	4			
143	20/14	47	M	L	FT	GLIOMA	HGG	2	P	P	P	A			DA	2			
144	30/14	51	F	R	F	GLIOMA	HGG	3	PP	P	P	P			GBM	4			
145	38/14	7	F	R	CEREBELLUM	LGG	LGG	1	P	P	A	A			PA	1			
146	39/14	57	M	R	PO	HGG	HGG	2	PP	P	P	P		SMALL CELL	GBM	4			
147	41/14	13	F	M	SS	CP	LGG	3	P	P	P	A			PA	1	NEG		
148	43/14	2	M	M	PO FO	EPEN	EPEN	2	P	P	A	A			EP	2			
149	45/14	51	M	R	TP	LGG	LGG	3	PP	P	P	P			AODG	3			
150	51/14	55	M	L	P	HGG	HGG	3	PP	P	P	P			GBM	4			
151	54/14	51	M	L	BG	HGG	HGG	3	PP	P	P	P			GBM	4	NEG		0+
152	57/14	60	M	R	PO	HGG	HGG	3	PP	P	P	P			GBM	4	pos 25%	WEAK	1+
153	62/14	32	M	R	FP	HGG	HGG	2	P	P	A	A			DA	2			
154	70/14	47	M	R	F	HGG	HGG	2	PP	P	P	A			OA	3			
155	73/14	63	M	R	FT	HGG	HGG	3	PP	P	P	A			AODG	2			
156	74/14	6	F	L	CEREBELLUM	MEDULLOBLASTOMA	MEDULLOBLASTOMA	2	P	P	P	A		CLEAR CELL	EP	2			
157	75/14	6	F	M	CEREBELLUM	LGG	PA	2	P	P	A	A			PA	2			
158	76/14	35	M	M	BS	LGG	MEDULLOBLASTOMA	2	P	P	A	A			ODG	3			
159	88/14	35	M	R	ON	LGG	LGG	1	P	P	P	A			ODG	2	NEG		0+
160	91/14	40	M	R	FTP	GLIOMA	HGG	2	PP	P	P	A			AA	3	POS 50%	WEAK	2+
161	97/14	72	M	L	T	AA	HGG	3	PP	P	P	P			GBM	4	FP 45%	STRONG	2+
162	112/14	60	M	M	ID EM	MENINGIOMA	LGG	1	P	P	P	A			EP	2			
163	118/14	33	M	L	F	HGG	HGG	2	P	P	A	A			ODG	2			
164	119/14	50	M	R	FP	HGG	HGG	3	PP	P	P	P			GBM	4			
165	120/14	43	M	R	T	GLIOMA	LGG	1	P	P	P	A			ODG	2			

S.NO	NP NO	AGE	SEX	SIDE	site	RADIOLOGY	SQUASH	HPE							DIAGNOSIS	GRADE	IHC		
								CELLULARITY	NP	MITOSES	VP	NEC	CA	OTHERS			CD117%	CD117-IN	SCORE
166	123/14	35	F	R	FP	LGG	LGG	1	P	P	P	A			DA	2			
167	155/14	32	M	M	4TH VEN	GLIOMA	EP	2	P	P	P	A			EP	2			
168	175/14	16	F	M	PO FO	LGG	LGG	1	P	P	A	A			PA	1			
169	176/14	2	F	M	PO FO	LGG	LGG	1	P	P	A	A			EP	2			
170	177/14	40	M	L	T	LGG	LGG	2	P	P	A	A			ODG	2			
171	188/14	45	F	L	F	MENINGIOMA	HGG	2	P	P	P	A			OA	2			
172	203/14	35	F	R	T	HGG	HGG	2	P	P	P	A			OA	2	NEG		0+
173	206/14	75	M	L	FP	ODG	ODG	3	P	P	P	A			ODG	2			
174	212/14	60	M	R	P	HGG	HGG	3	PP	P	P	P			GBM	4	pos 50%	WEAK	2+
175	218/14	47	M	R	F	HGG	LGG	2	P	P	P	A			ODG	2			
176	219/14	45	M	R	FP	LGG	LGG	2	PP	P	P	P			GBM	4			
177	224/14	47	F	L	F	HGG	HGG	2	P	P	P	A		RECURRENT	ODG	2	POS 75%	STRONG	4+
178	225/14	35	F	R	TP	GLIOMA	HGG	2	P	P	A	A			DA	2			
179	230/14	40	M	R	T	HGG	LGG	3	PP	P	P	P			GBM	4	NEG		0+
180	235/14	5	M	M	PO FO	LGG	LGG	2	P	P	P	A			PA	1	POS 75%	STRONG	4+
181	250/14	46	F	R	TP	LGG	LGG	2	P	P	A	A			ODG	2			
182	254/14	18	M	R	FP	HGG	HGG	2	P	P	P	A			PA	1			
183	256/14	53	M	L	FP	HGG	HGG	3	PP	P	P	P			GBM	4			
184	257/14	14	F	M	PO FO	LGG	LGG	2	P	P	A	A			PA	1			
185	259/14	43	M	R	TP	HGG	LGG	2	PP	P	P	A			PXA	2	NEG		0+
186	261/14	18	M	M	SS	PIT ADENOMA	PIT ADENOMA	2	P	P	P	A			EP	2	POS 75%	WEAK	3+
187	265/14	15	F	R	TP	LGG	LGG	2	P	P	P	A			PA	1			
188	270/14	1	M		F	HGG	HGG	2	PP	P	P	A			EP	2			
189	279/14	35	M	R	F	LGG	HGG	2	P	P	P	A			ODG	2	NEG		0+
190	285/14	60	M	R	F	GLIOMA	HGG	3	PP	P	P	P			GBM	4			
191	287/14	21	F	L	TP	GG	LGG	3	P	A	A	A			GG	2			
192	297/14	31	M	M	IMSOL	LGG	LGG	2	P	P	A	A			DFA	2			
193	299/14	23	M	L	T	LGG	LGG	2	P	P	P	A			DFA	2			
194	308/14	24	M	R	FP	HGG	HGG	3	PP	P	P	P			GBM	4			

S.NO	NP NO	AGE	SEX	SIDE	site	RADIOLOGY	SQUASH	HPE							DIAGNOSIS	GRADE	IHC		
								CELLULARITY	NP	MITOSES	VP	NEC	CA	OTHERS			CD117%	CD117-IN	SCORE
195	309/14	56	M	R	PO	HGG	HGG	3	PP	P	P	A			AA	3	NEG		0+
196	323/14	24	F	R	P	LGG	LGG	3	P	P	P	A			ODG	2			
197	324/14	42	M	L	T	LGG	LGG	3	P	P	A	A			DA	2			
198	329/14	45	F	M	IM SOL	GLIOMA	LGG	3	PP	P	P	A			DA	2			
199	331/14	42	F	L	F	GLIOMA	LGG	3	P	P	P	P			ODG	2			
200	334/14	29	M	M	IMSOL	EPEN	EPEN	2	P	P	A	A			EP	2			
201	342/14	55	M	R	PO	METS	EPEN	2	P	P	P	A			GBM	4			
202	347/14	44	F	L	F	GLIOMA	HGG	3	PP	P	P	A			AA	3	POS 70%	STRONG	3+
203	355/14	10	F	M	4TH VEN	MEDULLOBLASTOMA	LGG	2	P	A	A	A			PA	1			
204	357/14	61	F	L	F	GBM	HGG	3	PP	P	P	A			AA	3			
205	364/14	54	F	L	F	GBM	GBM	3	PP	P	P	P			GBM	4			
206	366/14	30	M	R	T	LGG	LGG	2	P	P	A	A			DFA	2			
207	374/14	4	F	R	F	LGG	LGG	2	P	P	A	A			PA	1			
208	375/14	15	F	M	IM SOL	HGG	HGG	1	P	P	A	A		TANYCYTIC	EP	2			
209	377/14	11	F	L	FP	LGG	LGG	1	P	P	P	A			PA	1			
210	382/14	45	M	R	F	LGG	LGG	1	P	P	A	A			ODG	2			
211	387/14	14	F	L	F	HGG	HGG	3	PP	P	P	P			AOA	3			
212	401/14	49	M	M	CC SOL	HGG	HGG	3	PP	P	P	P			GBM	4			
213	404/14	8	F	M	PO FO	MEDULLO	MEDULLOBLASTOMA	2	PP	P	P	A			PA	1			
214	412/14	25	M	R	FT	LGG	LGG	2	P	P	P	A			DA	2			
215	413/14	50	M	L	F	EPEN	EPEN	2	P	P	P	A			ODG	2			
216	416/14	40	F	R	PO	HGG	HGG	3	PP	PP	P	P			GBM	4			
217	418/14	18	M	M	PO FO	LGG	LGG	2	P	P	A	A			PA	1			
218	419/14	56	F	R	TP	LGG	LGG	2	PP	PP	PP	P			GBM	4			
219	428/14	64	M	R	TP	HGG	HGG	3	PP	PP	P	P			GBM	4			
220	430/14	40	M	R	F	HGG	HGG	3	PP	P	P	P			GBM	4			
221	432/14	40	M	L	TP	HGG	HGG	3	PP	PP	P	P			GBM	4			
222	439/14	36	M	L	F	LGG	LGG	2	P	P	A	A			PA	1	POS 85%	WEAK	4+

S.NO	NP NO	AGE	SEX	SIDE	site	RADIOLOGY	SQUASH	HPE							DIAGNOSIS	GRADE	IHC		
								CELLULARITY	NP	MITOSES	VP	NEC	CA	OTHERS			CD117%	CD117-IN	SCORE
223	443/14	39	F	L	T	GLIOMA	HGG	3	PP	P	P	P			GBM	4			
224	444/14	55	F	R	F	HGG	HGG	3	PP	P	P	P			GBM	4			
225	447/14	46	M	L	T	HGG	HGG	3	PP	P	P	A			AEP	3			
226	452/14	11	M	R	F	LGG	HGG	2	PP	P	A	A			PXA	2			
227	457/14	36	F	L	T	HGG	HGG	3	PP	P	P	P			GBM	4			
228	465/14	38	M	R	F	HGG	HGG	2	PP	P	A	A			ODG	2			
229	468/14	55	F	R	LAT VEN	LGG	LGG	2	P	P	P	A			DA	2			
230	469/14	45	F	R	TP	LGG	LGG	3	P	P	P	A			ODG	2			
231	475/14	40	M	L	P	LGG	LGG	3	PP	P	P	P			GBM	4	pos 50%	STRONG	2+
232	480/14	50	F	L	P	METASTASES	HGG	2	PP	PP	PP	P			GBM	4			
233	483/14	36	F	R	F	GRANULOMA	GLIOMA	3	P	P	P	A			DA	2			
234	489/14	30	F	L	F	HGG	HGG	3	PP	P	P	A			AA	3			
235	491/14	70	M	M	ED SOL	HGG	HGG	3	P	P	A	A			DA	2			
236	499/14	46	F	R	T	HGG	HGG	2	P	P	P	A			AA	3	POS 50%	WEAK	2+
237	508/14	8	F	R	CEREBELLUM	LGG	LGG	2	P	P	A	A			PA	1	POS 70%	STRONG	3+
238	510/14	52	M	L	T	GLIOMA	HGG	3	PP	P	P	P			GBM	4			
239	513/14	28	M	L	FT	HGG	HGG	2	P	P	A	A			ODG	2			
240	511/14	49	L	FP	FP	HGG	HGG	2	P	P	P	A			PXA	2			
241	519/14	53	M	M	CC SOL	HGG	HGG	2	P	P	A	A			DA	2			
242	536/14	78	F	L	TP	LGG	HGG	3	PP	P	P	P			GBM	4	NEG		0+
243	539/14	6	F	M	IM SOL	LGG	LGG	2	P	P	A	A			PA	1	NEG		0+
244	547/14	78	F	L	TP	LGG	LGG	3	PP	P	P	P			GBM	4			
245	552/14	36	F	L	PO	HGG	HGG	3	PP	P	P	P			GBM	4			
246	555/14	28	M	L	PO	LGG	LGG	2	P	P	A	A		RECURRENT	AA	3			
247	559/14	26	M	L	TP	HGG	HGG	3	PP	P	P	P			GBM	4			
248	563/14	4	F	M	PO FO	PA	PA	2	P	P	P	P			PA	1			
249	578/14	60	M	R	F	GLIOMA	HGG	3	PP	P	P	P			GBM	4			
250	580/14	40	M	L	PO	GLIOMA	R..GLIOSIS	3	P	P	A	A			DA	2			

S.NO	NP NO	AGE	SEX	SIDE	site	RADIOLOGY	SQUASH	HPE							DIAGNOSIS	GRADE	IHC		
								CELLULARITY	NP	MITOSES	VP	NEC	CA	OTHERS			CD117%	CD117-IN	SCORE
251	583/14	11	F	L	FT	HGG	HGG	3	PP	PP	P	A			AEP	3			
252	588/14	35	M	R	FP	EPEN	EPEN	2	P	P	P	A			EP	2			
253	589/14	25	M	L	F	LGG	LGG	3	PP	P	P	A			ODG	2			
254	591/14	45	F	R	F	HGG	HGG	3	PP	P	P	P			GBM	4			
255	606/14	75	F	R	FT	GBM	HGG	3	PP	PP	P	PP			GBM	4			
256	612/14	52	M	R	TP	GLIOMA	GBM	3	PP	PP	PP	P			GBM	4			
257	618/14	50	M	R	T	METS	HGG	3	PP	PP	P	P			GBM	4			
258	628/14	38	F	L	FTP	TUBERCULOMA	LGG	2	P	P	A	A			PA	1			
259	631/14	50	F	R	PO	METASTASES	GRANULOMA	2	P	PP	P	PP			GBM	4			
260	635/14	8	F	M	PO FO	EPEN	EP	2	P	P	A	A			EP	2			
261	646/14	50	F	M	CC SOL	LGG	LGG	2	P	P	P	A			OA	2			
262	651/14	60	M	L	F	ABCESS	HGG	3	PP	P	PP	PP			GBM	4			
263	652/14	83	M	L	TP	METASTASES	GBM	3	P	PP	P	PP			GBM	4			

KEY TO MASTER CHART

Age		-	Entered in years
Sex	M	-	MALE
	F	-	FEMALE
Side	R	-	right
	L	-	left
	M	-	midline

Site :

F	-	FRONTAL
FP	-	FRONTOPARIETAL
FT	-	FRONTO TEMPORAL
FTP	-	FRONTOTEMPOROPARIETAL
T	-	TEMPORAL
TP	-	TEMPOROPARIETAL
P	-	PARIETAL
O	-	OCCIPITAL
PF	-	PARIETOFRONTAL
BS	-	BRAIN STEM
CC	-	SOLCORPUS CALLOSUM
IV	-	INTRAVENTRICULAR
		4^{TH} VENTRICLE
PO FO	-	POSTERIOR FOSSA
ON	-	OPTIC NERVE
OC	-	OPTIC CHIASMA
BG	-	BASAL GANGLIA
SS	-	SUPRASELLAR
ED SOL	-	EXTRA DURAL SOL
ID IM SOL	-	INTRADURAL INTRAMEDULLARY SOL
ID EM	-	INTRADURAL EXTRAMEDULLARY SOL

RADIOLOGY& SQUASH

LGG	-	LOW GRADE GLIOMA
HGG	-	HIGH GRADE GLIOMA
SOL	-	SPACE OCCUPYING LESION
PA	-	PILOCYTIC ASTROCYTOMA
DA	-	DIFFUSE ASTROCYTOMA
ODG	-	OLIGODENDROGLIOMA
AA	-	ANAPLASTIC ASTROCYTOMA
MEDULLO	-	MEDULLOBLASTOMA
PIT ADENOMA	-	PITUITARY ADENOMA
CP	-	CRANOPHARYNGIOMA
GBM	-	GLIOBLASTOMA MULTIFORME
METS	-	METASTASES
PNET	-	PRIMITIVE NEURECTODERMAL TUMOUR

CELLULARITY

1	-	LOW
2	-	MODERATE
3	-	HIGH

NP-NUCLEAR PLEOMORPHISM

1+-P MILD NUCLEAR PLEOMORPHISM

2+ PP marked NUCLEAR PLEOMORPHISM

MITOSES

A-ABSENT

P-PRESENT

VP-VASCULAR PROLIFERATION

A-ABSENT

P-PRESENT

NEC-NECROSES

A-ABSENT

P-PRESENT

CA-CALCIFICATION

HPE DIGNOSIS

PA	:	pilocytic astrocytoma
DFA	:	diffusefibrillary astrocytoma
DA	:	diffuse astrocytoma
ODG	:	oligodendroglioma
EPEN	:	ependymoma
MPEP	-	myxopapillaryependymoma
T	-	ependymoma-tanycyticependymoma
OA	-	oligoastrocytoma
PXA	;	PleomorphicXanthoastrocytoma
OA	:	oligoastrocytoma
GG	-	ganglioglioma
Des as	-	desmoplastic astrocytoma
AODG	-	anaplastic oligodendroglioma
AA	:	anaplastic astrocytoma
GBM	:	Glioblastomamultiforme

Whograde

GRADE I	**:**	Neoplasms with low proliferative tendency
GRADE II	**:**	Neoplasms with cytological atypia alone
GRADE III	**:**	Neoplasms with anaplasia and mitotic activity
GRADE IV	**:**	Neoplasms with micro vascular proliferation and/ornecrosis

IHC

CD117 –POS-POSITIVE

NEG –NEGATIVE

CD117 STAINING INTENSITY

WEAK ,MOD-MODERATE,STRONG

CD117 SCORE

score 0 - no immunoreactive cells

score 1+-1-10%

score 2+ 11-50%

score3+ 51-75%

score4+ more than 75% [(128)]