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Original Research Article

A Study of Incidence and Histopathological Spectrum of Glial Tumors on Routine Paraffin Sections with Frozen Section Correlation

Pooja N. Gauswami[1], Pooja A. Mistry[2], Kena A. Patel[3]

[1,2]Senior Resident, Department of Pathology, GMERS Medical College, Vadnagar, Gujarat, India
[3]Assistant Professor, Department of Pathology, GMERS Medical College, Vadnagar, Gujarat, India

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Corresponding author: Dr. Pooja N Gauswami
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Abstract

Introduction: Central nervous system tumors account for 10% of all neoplasms, with glial tumors being the most prevalent. Intraoperative frozen section (FS) is a routine practice used to provide primary diagnoses that guide surgical approaches and ensure specimen adequacy.

Aims and Objectives: This study investigated the incidence and histopathological spectrum of glial tumors and evaluated the diagnostic accuracy of FS compared to the gold standard of routine histopathology (HPE).

Materials and Methods: 100 cases clinically and radiologically diagnosed as glial neoplasms at Civil Hospital, Ahmedabad, were evaluated. Squash smears and FS were prepared intraoperatively and compared with permanent paraffin sections stained with H&E. Concordance was categorized as complete, partial, or discordant.

Results: Astrocytomas were the most frequent tumors (71/100), with Glioblastoma Multiforme (GBM) (25) and fibrillary astrocytoma (22) being the most common variants. The mean age was 49.6 years with a male-to-female ratio of 1.38:1. The parietal lobe was the most common site (65%). Results showed 67 complete and 17 partial concordances, with a 16% discordance rate. GBM showed the highest concordance. Discrepancies were mainly due to freezing artifacts, necrotic tissue, and inadequate sampling.

Conclusion: Astrocytoma is the most common glial tumor, with WHO grades typically increasing with age. FS is an accurate intraoperative guide but remains subject to pitfalls like freezing artifacts and multifocality.

Keywords: Glial Tumors; Frozen Section; Histopathology; Astrocytoma; Glioblastoma Multiforme; Diagnostic Accuracy; Intraoperative Consultation.

Introduction

Central nervous system tumors consist of 10 % of all tumors, Glial tumors being the most common. Histopathological examination gives definitive information regarding grading and variants of glial tumors. Intra operative frozen section diagnosis is nowadays a routine practice in most institutions, thus accuracy in diagnosis of frozen section must be assessed and compared with the final diagnosis of routine histopathology.

Many studies have confirmed the accuracy of FS diagnosis for assessment of the CNS lesions, with acceptable accuracy. [1-6]

Aims and Objectives

- To study the incidence and histopathological spectrum of various glial tumors.
- To evaluate accuracy of frozen sections in the diagnosis of glial tumors.

Materials and Methods

From the received tissue for frozen section, a tiny portion (1–2 mm3) of tissue was squashed between two slides to prepare smears as described by Adams et al. [7] Squash smears were immediately immersed in methanol fixative for subsequent by the rapid H&E staining procedure. The residual tissue was submitted for FS. Five-micrometer sections were cut using the cryotome and sections were stained by the rapid haematoxylin and eosin (H&E) method.

Subsequently, for the permanent section, the specimen was fixed overnight in 10% buffered formalin, grossed and adequate representative sections were taken according to the standardized guidelines. The permanent sections were initially evaluated on H&E-stained sections. Special stains were performed for confirmation of diagnosis. Histological diagnosis was made according to the criteria set forth in pathology textbooks for diagnosis of CNS lesions [8]. For histological

typing of tumors, WHO recommendations [9] were followed. All cases were categorized according to the diagnosis given on frozen section & routine histopathology and results were compared to one another. The results from the permanent sections were used as a gold standard.

Total 100 cases, clinically and radiologically diagnosed as glial neoplasms, from civil hospital, Ahmedabad were evaluated both on FS followed by HPE. The cases were categorized according to degree of concordance of FS diagnosis with final diagnosis on routine HPE.

1- FS diagnosis was exactly the same as the final diagnosis (complete concordance);

2 - FS diagnosis was not incorrect but was too broad to qualify as complete concordance (partial concordance); or,

3- FS diagnosis was incorrect and different from the final diagnosis (no concordance or discordant).

Discordant cases were analyzed for the causes of discrepancies.

To describe data, we used mean, standard deviation, median, and percent.

Results

Out of 100 cases, 71 were Astrocytoma. Among them, most common were fibrillary astrocytoma (22) and glioblastoma multiforme (25).

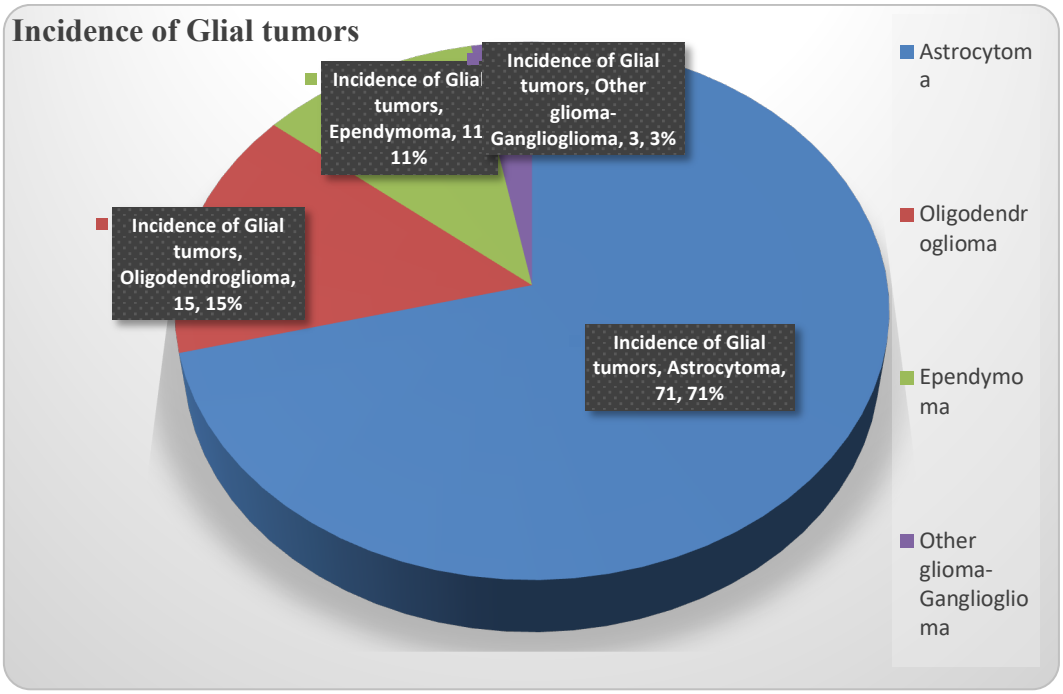

Figure 1: Inxidance of various Glial tumors

Table 1: Age vise incidance of Glial Tumors

CNS Tumor	No.of cases according to Age(in years)				Total
Astrocytoma	0-20	21-40	41-60	>60	
Pilocytic (I)	4	0	0	1	5
Fibrillary (II)	10	10	2	0	22
Gemistocytic(II)	1	2	1	0	4
Gemistocytic(III)	0	0	1	0	1
Pilomyxoid (II)	3	0	0	0	3
PXA	0	0	0	0	0
Anaplastic (III)	4	2	3	0	9
GBM (IV)	2	8	10	5	25
Giant cell GBM (IV)	0	0	1	1	2
Oligodendroglioma (II)	2	6	0	0	8
Oligodendroglioma (III)	0	3	4	0	7
Ependymoma (II)	8	1	1	1	11
Ganglioglioma	2	1	0	0	3

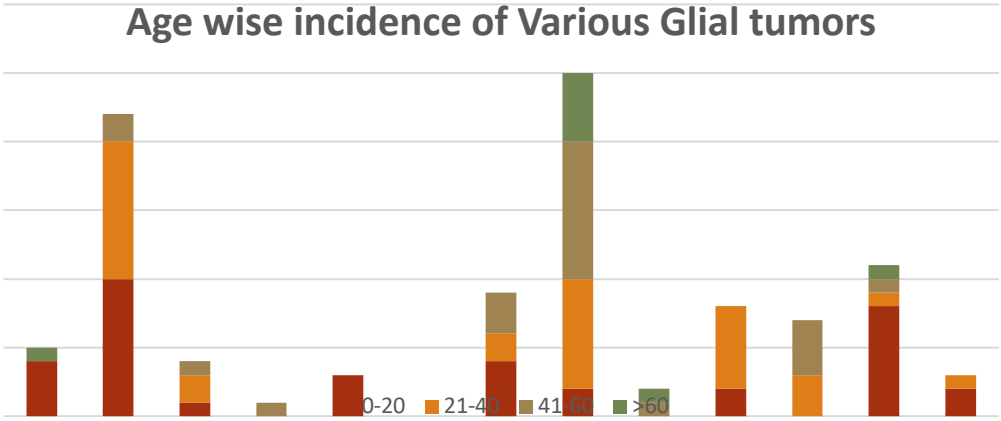

Figure 2: Age wise incidence of Various Glial tumors

Age for glial tumors ranged from 2-68 years, mean age being 49.6 years. Male: Female ratio for glial tumors was 1.38:1. Fibrillary astrocytoma (grade II) was the commonest variant found among younger age group whereas Glioblastoma (grade IV) was particularly common in older age. The majority of tumors (65%) were located in parietal lobe, frontal lobe (13%), and temporal lobe (12%).10% of tumors were located at other sites. Results of comparison study showed 67 & 17 cases to be completely concordant & partially concordant respectively, while 16 cases were discordant. Among the completely concordant cases, Glioblastoma multiforme (GBM) shows the highest concordance frequency. Table: 2 shows the discordant cases and their diagnoses on FS and routine HPE. Partially concordant cases included cases like: High grade glioma on FS and Anaplastic astrocytoma on HPE, Low grade glioma on FS and Oligodendroglioma II on HPE, etc.

Table 2: Correlation between routine Histopathology and frozen section diagnosis of Glial tumors

Sr.No.	Permanent diagnosis on routine HPE	Frozen Section diagnosis	No. of cases
1.	No opinoin is given because of necrotic tissue	Low grade Astrocytoma	1
2.	Glioblastoma multiforme IV	Necrotic and inflammatory tissue only	1
3.	Anaplastic astrocytoma III	Medulloblastoma	1
4.	Astrocytoma grade II	Ependymoma II	1
5.	Glioblastoma multiforme IV	Low grade oligodendroglioma	1
6.	Ganglioglioma I	Low grade oligodendroglioma	1
7.	Oligodendroglioma II	Central neurocytoma	1
8.	Astrocytoma I	Schwannoma	1
9.	Glioblastoma multiforme	Medulloblastoma	1
10.	Pilocytic astrocytoma	Glioblastoma multiforme	1
11.	Oligodendroglioma III	Medulloblastoma	1
12.	Gemistocytic Astrocytoma (low grade)	High grade astrocytoma	2
13.	Anaplastic oligodendroglioma	Glioblastoma multiforme	1
14.	Grade II Astrocytoma	Medulloblastoma	1
15.	Ependymoma II	Neurocytoma II	1

Discussion

Astrocytomas are the commonest glial tumors, Fibrillary type in younger age whereas glioblastoma in older age. Glioma is more common in males. Glioma can occur anywhere in the brain-parietal lobe is more common though.

Intra-operative frozen section is a routine practice nowadays. It provides surgeons with a primary diagnosis that is helpful to decide a subsequent surgical approach. It can inform the surgeon as to whether the biopsy is taken from the appropriate area and the adequacy of the specimen that is important to the pathologist to make a final diagnosis on the permanent sections can be determined [10]. Findings of this study is comparable to other studies as summarized in table.3.

Table 3: Comparison to other study

Sr. no.	Parameter	Current study	Study by Khoddami [11]	Study by Savargaonkar [3]
1.	Concordance rate	84%	90.6%	94%
3.	Discordance rate	16%	9.4%	6%

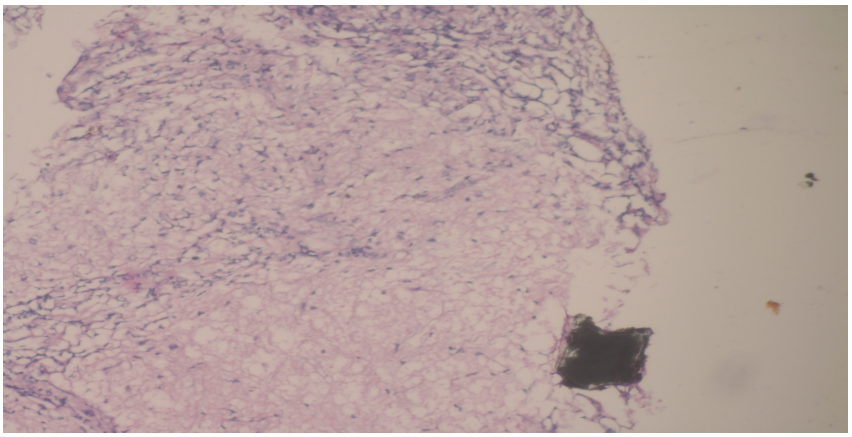

Figure 3: Low grade Astrocytoma on FS

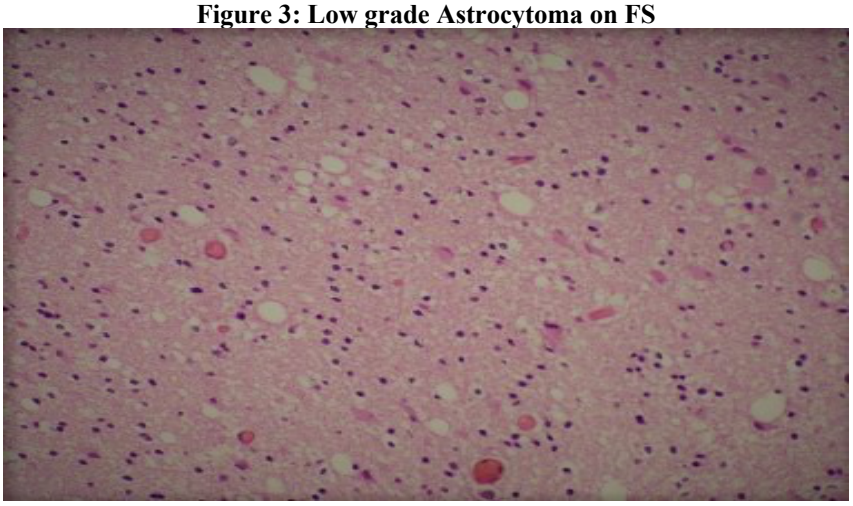

Figure 4: Fibrillary astrocytoma (II) on permanent sections

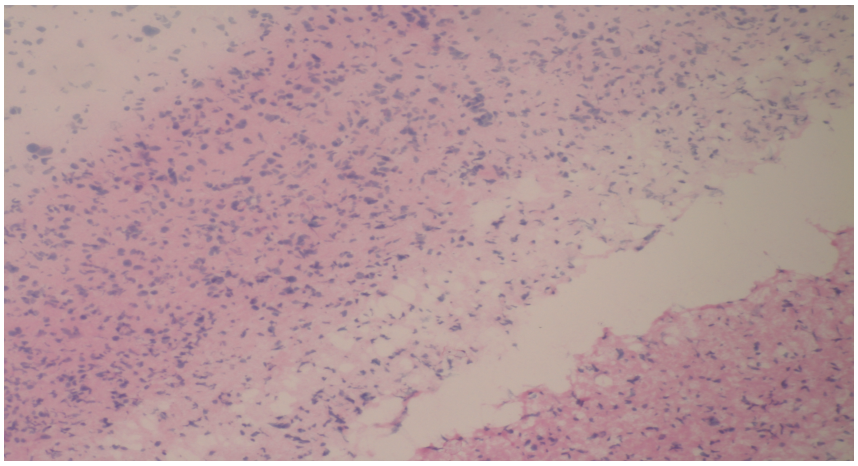

Figure 5: GBM on FS

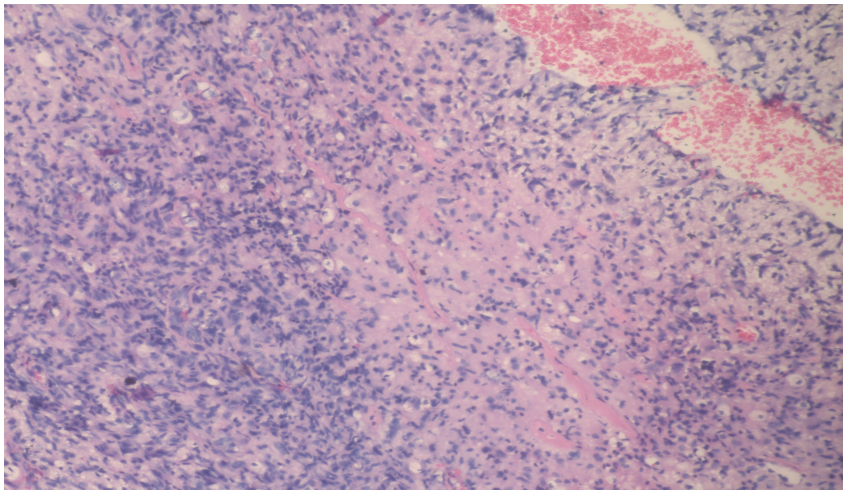

Figure 6: GBM on permanent sections

Discrepancies were mainly seen with Low grade Astrocytoma which were falsely diagnosed as high grade astrocytoma (majority), medulloblastoma or ependymoma on FS. Mainly Due to 1) the soft and friable nature of tumors, 2) marked freezing artefacts, 3) Thicker sections [12] Paraffin sections showed that in undergraded cases, there were areas of both high- and low-grade types and tissue sampling might have failed to show the anaplastic areas as also cited by Shah et al. [14]

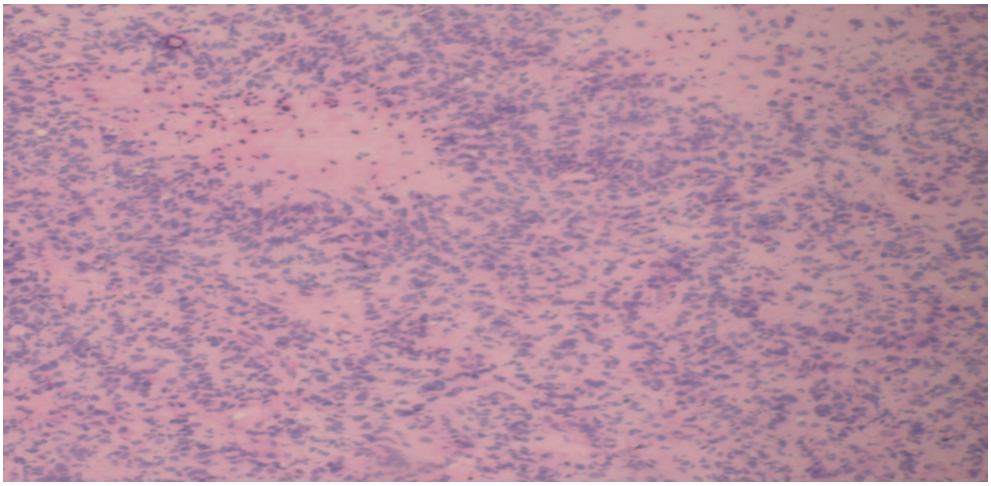

Figure 7: High grade glioma on FS

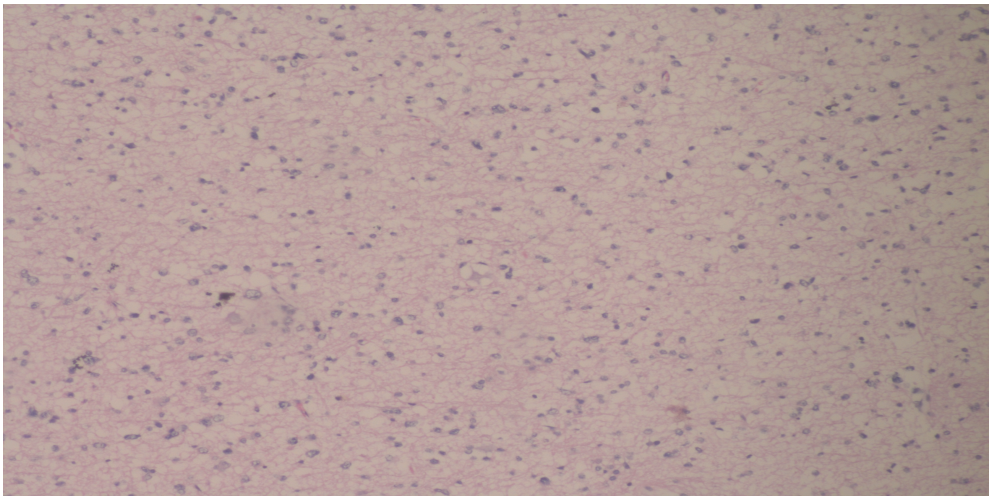

Figure 8: Pilocytic Astrocytoma (I) on Permanent sections

Similar problems occurred when there were tumors with necrotic focus.

Frozen section couldn't be evaluated because sampling was done from a necrotic area and final diagnosis were made from permanent sections afterwards. In the present study, there was a problem in assessing oligodendroglioma in frozen section, which was misdiagnosed as high-grade astrocytoma, because of two reasons- 1) Freezing artefact 2) High vascularity.

Mitra et al. and Plesac and Prayson have also reported similar problems [13,2]

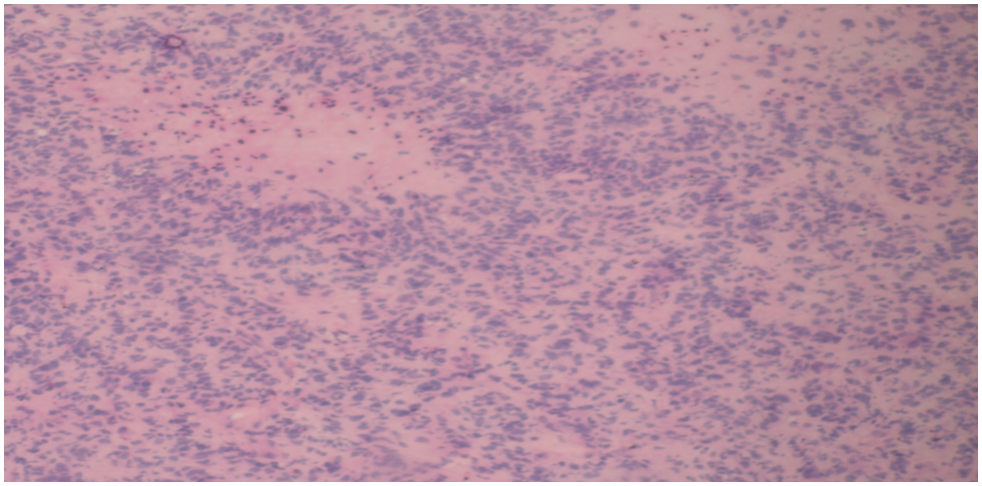

Figure 9: GBM on FS

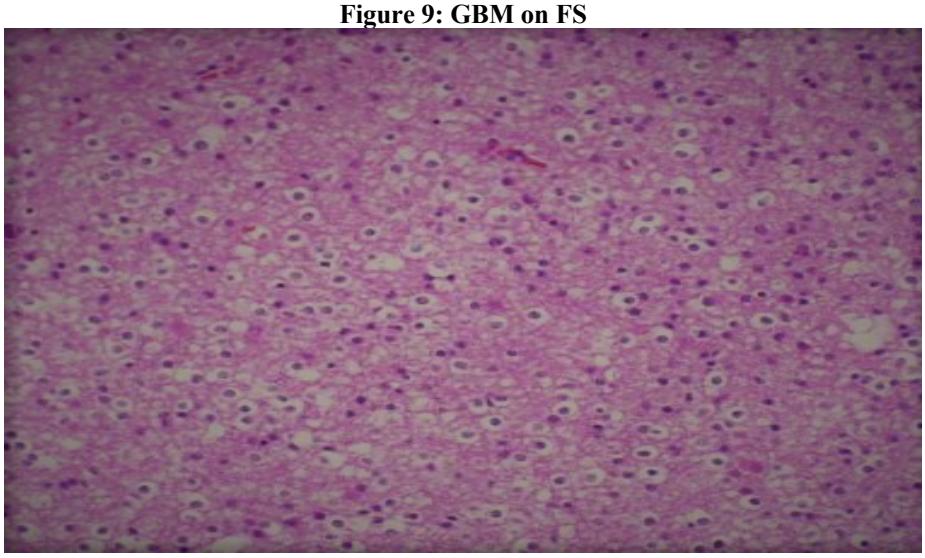

Figure 10: Oligodendroglioma on permanent sections

Conclusion

Astrocytoma is the commonest glial tumor found both in pediatric and adult age, WHO grade was increased with advancing age.

Frozen sections can be used as an accurate guide to intra- and perioperative management of glial tumors but with pitfalls mainly due to freezing artefact, multifocality and nature of tumors, inadequate sampling.

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