



Assessment of Mast Cell Density in primary CNS tumor in relation to the type and grade of tumor: A hospital-based study in Eastern India

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Abstract

Introduction: Primary Central Nervous System (CNS) tumors constitute about 50% of all intracranial neoplasms. They originate from both mature and embryonic tissues. Mast Cells (MCs) play an important role in angiogenesis by secreting many angiogenic agents and regulates angiogenesis in many tumors and also in brain. They also play an important role in tumor progression, peritumoral edema formation and prognosis.

Objective: This study has been conducted to know the Mast cell density (MCD) in various CNS Neoplasm and to study any correlation between MCD and Grade of tumors.

Methods: All the surgically resected primary central nervous system tumor samples, those came to department of pathology from October 2016 to February 2018 was studied.

Results: Mean MCD in meningioma is 23 cells/mm². In case of secretory meningioma, MCD is significantly higher. Mean MCD of astrocytic and oligodendroglial tumors is 14 cells/mm². Grade II tumors have high MCD compared to Grade III tumors. Mean MCD in

schwannoma is 47 cells/mm², range being 40 to 60 cells/mm².

Conclusion: In meningioma MCD is related to histological type of tumour. No association between grade and MCD has been observed. MCs are distributed randomly within tumor tissue. In astrocytic and oligodendroglial tumour MCD is higher in low grade tumours and in Schwannoma, MCD is higher.

Keywords: Primary CNS tumor, Meningioma, Astrocytoma, Schwannoma, Mast cell

Introduction

Primary Central Nervous System (CNS) tumors originate from various tissues like, glial tissue, neuronal tissue, meningeal tissue component or embryonic tissue. They constitute about 50% of all intracranial neoplasms. In adult, two-third of the tumors are supratentorial whereas in children, two-third tumors are infratentorial. The International Agency for Research on Cancer estimated that in 2012, brain and nervous system cancer occurred in 1,39,608 men and 1,16,605 women worldwide.^[1]

Aims and objectives

There are conflicting reports regarding association of Mast cells (MCs) and grade of meningioma. This study was conducted to see the Mast Cells Density (MCD) in meningiomas and other primary CNS tumors and also to observe any relation between Mast Cells Density and grade of Primary CNS tumors.

Materials and Methods

It is a Retrospective Observational study conducted during the period from October 2016 to February 2018, after getting clearance from Institutional Ethics Committee. All the primary CNS tumors presented to Department of Pathology during the period were studied. Metastatic CNS tumors and hematolymphoid malignancies affecting CNS were excluded from the study. Immature and mature teratomas were also not included in the study, because of presence of various tissue elements in it.

After gross examination, tissues were subjected to formalin fixation, routine processing and paraffin embedding. 3-4 μ thick sections on 2 slides were prepared from each specimen. Routine Hematoxylin-Eosin stain used for histopathological examinations and 1% Toluidine blue stain used for detection of mast cells. Mast cell density is expressed as number of mast cells per square mm.

Result and analysis

During the study period, total 21 cases were studied.

As shown in table 1, in this study, meningiomas were mainly found in age group of 41 to 50 years and clearly there is female preponderance. Amongst the 11 cases of meningioma, 10 cases are WHO Grade I and 01 case is WHO Grade II. Mean MCD in meningioma is 23 cells/mm². In case of secretory meningioma, MCD is significantly higher being 80 cells/mm². We do not find any correlation between grade of meningioma and MCD.

Astrocytic and oligodendroglial tumors occur mainly in males and age group mostly affected is 3rd decade, as shown in table 2. Among the 5 cases 02 are Grade II, 02 are Grade III Astrocytoma and 01 case is Oligodendroglioma. Mean MCD of astrocytic and oligodendroglial tumors is 14 cells/mm². Grade II tumors have high MCD compared to Grade III tumors (30 cells/mm² vs 05 cells/mm²).

In this study, Male: Female ratio in Schwannoma is 1:1.5 and occurs after second decade. Mean MCD in Schwannoma is 47 cells/mm², range being 40 to 60 cells/mm².

Discussion

Mast Cells (MCs) are multi-effector cells originating from bone marrow progenitor cells and later acquire the characteristic of the homing tissue. MCs influence tumor development by affecting tumor cells directly, by activating tumorigenic inflammatory cells or by modulating tumor microenvironment.^[2,3] In human brain MCs found in many areas like, the pituitary stalks, the pineal gland, thalamus, hypothalamus, medial eminence etc.^[4] In meninges they are located within dural layer in association with vessels and meningeal nociceptor terminals.^[5] There are gradually increasing evidences that MCs participate in neuroinflammation both directly and through stimulation of microglia.^[6] MCs play an important role in angiogenesis by secreting many angiogenic agents particularly Vascular Endothelial Growth Factor (VEGF), which is one of the principal regulator of angiogenesis in many tumors and also in brain.^[7,8] Hypoxia and MCs are involved in meningioma progression, peritumoral edema formation and poor prognosis.^[9]

In our study, mean MCD in meningioma is 23 cells/mm². In case of secretory meningioma, MCD is significantly higher being 80 cells/mm². and mainly perivascular in location. Tirakotai et al also found that secretory

meningiomas were infiltrated by a higher number of MCs compare to other non-secretory variants. Higher number of MCs were found mainly in and around psammoma bodies of secretory meningioma.^[10] It was also shown in various studies that Angiomatous meningioma and chordoid meningioma are associated with elevated MCs.^[11,12,13] MCs in meningiomas are mainly perivascular in location and associated with peritumoral edema particularly in high grade tumors.^[14] In our study we do not found any correlation between MCD and grade of meningioma.

In gliomas MC recruitment depends on grade of tumor.^[15]

In our study, mean MCD of Astrocytic and oligodendroglial tumors is 14 cells/mm². Grade II tumors have high MCD compared to Grade III tumors (30 cells/mm² vs 05 cells/mm²). But Polajeva et al, in their study found that Glioblastoma multiforme contains a higher concentration of MCs than grade II tumors.^[16]

Mean MCD in Schwannoma is 47 cells/mm², range being 40 to 60 cells/mm².

Some investigators observed that MCs are located exclusively in tumor mass but other found MCs in close association with endothelial cells and stromal cells.^[17, 18]

Merrill M J et al observed that MCs are distributed randomly throughout tumor singly or in clusters, and any perivascular cuffing by MCs around tumor vasculatures were not noted by them.^[19]

This study has been conducted with low number of cases. Further study is needed with large number of cases to confirm this study.

Conclusion

In meningioma MCD is related to histological type of tumor. No association between grade and MCD has been observed. MCs are distributed randomly within tumor tissue. In astrocytic and oligodendroglial tumor MCD is

higher in low grade tumors and in Schwannoma, MCD is higher.

Limitations

This study has been conducted with low number of cases. Further study is needed with large number of cases to confirm this study.

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TABLES

Table 1: Age and Sex distribution in Meningioma

Age (in years)	Male	Female
31-40	1	1
41-50	1	4
51-60	1	3
Total	3	8

Table 2: Age and Sex distribution in Astrocytic and oligodendroglial tumors and Schwannoma

Age (in years)	Astrocytic and oligodendroglial tumors		Schwannoma	
	Male	Female	Male	Female
1-10		1		
11-20				
21-30	2		1	1
31-40	1			1
41-50				
51-60	1		1	1
Total	4	1	2	3

Figures

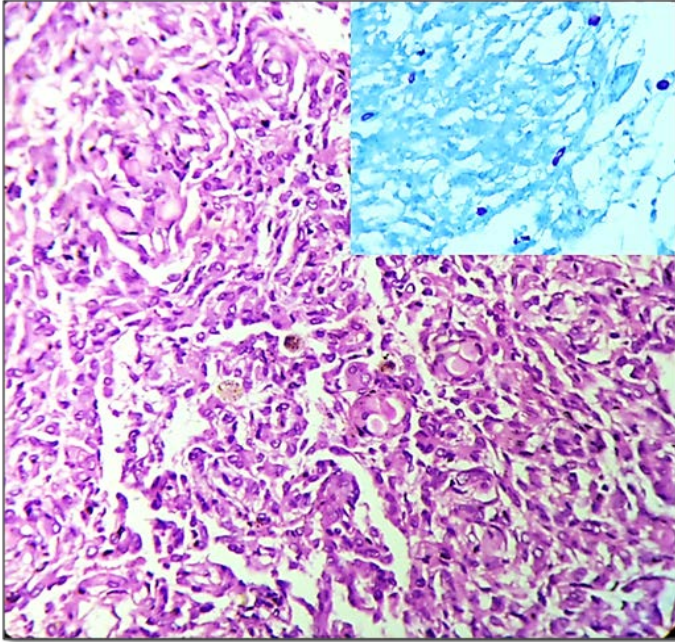


Figure 1: Secretory Meningioma H&E, inset: Toluidine blue stain showing Mast Cell (X400)

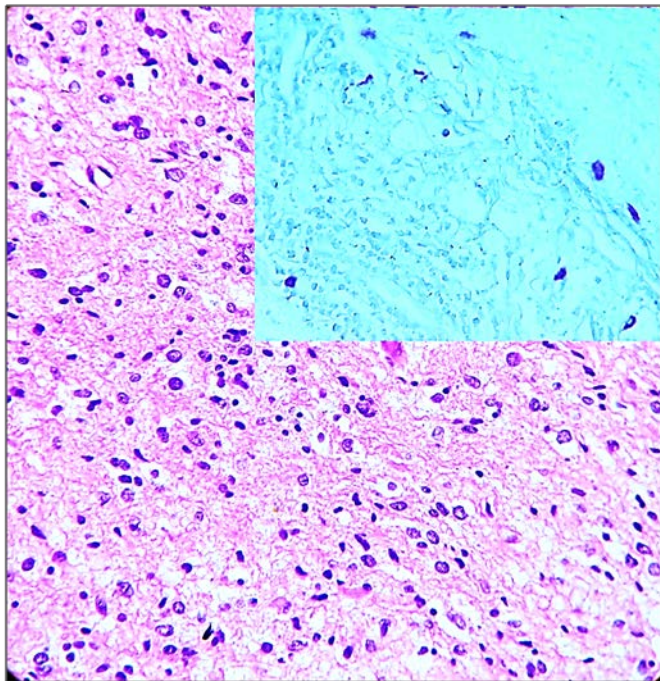


Figure2: Grade II Astrocytoma H& E, inset: Toluidine blue stain showing Mast Cell (X400)