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Original Research Paper

Pathology

CLINICOPATHOLOGICAL STUDY OF MENINGIOMA: 10 YEAR EXPERIENCE FROM A TERTIARY CARE HOSPITAL

Vipra Malik	Department of Pathology, GMCH-32 Chandigarh,India
RPS Punia*	Department of Pathology, GMCH-32 Chandigarh,India *Corresponding Author
Arvind Malhotra	Department of Neurosurgery, GMCH-32 Chandigarh,India
Vipin Gupta	Department of Neurosurgery, GMCH-32 Chandigarh,India

ABSTRACT

INTRODUCTION: Meningiomas are neoplasms derived from arachnoidal cap cells in the meningeal coverings of the spinal cord and brain. They constitute one of the most common benign intracranial tumours.

MATERIAL AND METHODS: It was a single centre retrospective observational study of 126 cases from 2007 to 2016.

RESULTS: Meningiomas accounted for 20.5% of all CNS lesions. Mean age of patients was 47.6 years. Females had higher predilection for meningioma. The most common clinical symptom was headache (38.9%). Cerebral convexity was the most favoured site (42.1%). Grade I meningiomas were 85.7%, grade II were 11.9% and grade III were 2.4%. Transitional meningioma was most common variant (53.2%) followed by atypical type (11.1%) and meningothelial type (9.5%). Males were found to have a much higher incidence of grade II meningiomas (7.9%) and grade III meningiomas (2.4%).

CONCLUSION: Histological variants of meningioma aid in prognostication and treatment.

KEYWORDS : Meningioma, WHO grade, atypical, anaplastic

Introduction

The term meningioma was proposed by Harvey Cushing in 1922 for the tumours arising from the arachnoid cells present in arachnoid villi and granulations and in the stroma of perivascular spaces and choroid plexus (Okonkwo & Laws, 2009). Meningiomas account for 28-30% of primary central nervous system tumours (Louis et al., 2007). Meningiomas are slow growing tumours and are typically attached to the surface of duramater. They produce neurological signs and symptoms due to compression of surrounding structures. Imaging plays an important role in characterising these lesions and helping in optimising the treatment strategies.

The wide histological spectrum and diverse clinical behaviour form the basis of WHO classification, which categorises them into three grades – Grade I (benign), Grade II (atypical) and Grade III (anaplastic). Grade I meningiomas are characterised by their distinct histological type and absence of anaplastic features. Grade II meningiomas (atypical) are defined by one or more of the following four criteria: 1) chordoid or clear cell histologic subtype, 2) four to 19 mitoses per ten high-power field (HPFs), 3) brain infiltration, and 4) three or more of the following five histologic features: small cell change, increased cellularity, prominent nucleoli, sheet-like growth, or necrosis. Grade III meningiomas (anaplastic/malignant) are defined by rhabdoid or papillary subtypes, a histological picture of frank malignancy resembling that of carcinomas, melanomas, or high grade sarcomas, or 20 or more mitosis per ten HPFs (Louis et al., 2016).

Even after complete removal, 10-32% cases have been reported to recur within 10 years (Maiuri et al., 2007; Simpson 1957). Recurrence has largely been defined by histological grade, subtotal resection, young age, specific subtypes, brain infiltration and high proliferative rate (Maiuri et al., 2007; Simpson 1957).

The aim of the present study was to gain an insight into the wide histopathological spectrum of meningiomas and to delineate their respective frequencies.

Material And Methods

The present study was a retrospective study conducted in the Department of Pathology and Neurosurgery, Government Medical College and Hospital (GMCH), Chandigarh. During this study, 126 cases of meningiomas diagnosed over a period of 10 years (January 2007 to December 2016) were reviewed retrospectively. These were studied in detail with respect to clinical parameters, radiological findings and histomorphological features. Biopsy slides stained with haematoxylin and eosin were retrieved from the archival material. The cases were classified on the basis of histomorphological findings.

Results

Of the total 620 CNS lesions, 126 cases (20.3%) were diagnosed as meningiomas. Meningiomas were most common in 4th-6th decade (59, 46.8%) followed by 2nd- 4th decade (37, 29.3%). It was least common in the extremes of age. The mean age of occurrence of meningioma was 47.6 years (range:8-84) years. Females were more commonly affected compared to males with male-to-female ratio being 1:1.8. The most common clinical symptoms were headache (49, 38.9%), seizures (27, 21.4%) and vision problems (24, 19.1%). Lower limb paralysis (13, 10.3%) and vomiting (11, 18.7%) were other common clinical presentations. Most of the meningiomas were found in the intracranial region (96, 76.2%). Cerebral convexity was the most favoured site (53, 42.1%) followed by skull base and posterior fossa (15, 11.9%). Intraspinal meningiomas also contributed a significant proportion (30, 23.8%) with most of them being located in the thoracic spine (16, 53.3%). Two cases were reported at rare locations including eyelid and orbital nerve sheath Of these 126 cases, histopathological diagnosis of meningioma was consistent with the clinico-radiological diagnosis in 112 cases (88.9%).

Based on WHO grading criteria, grade I meningiomas were most common (108, 85.7%) followed by grade II (15, 11.9%) and grade III (3, 2.4%). Transitional meningioma (67, 53.2%) was the most common histological subtype reported followed by meningothelial meningioma (22, 17.3%) and atypical meningioma (14, 11.1%), (Table 1, Figure 1). Of the intraspinal meningiomas, transitional meningioma (19, 63.3%) was the most common histological subtype reported followed by psammomatous meningioma (4,6.3%).

TABLE 1: Histological subtypes of meningioma

WHO GRADE	HISTOLOGICAL SUBTYPE	DISTRIBUTION (N=126)
WHO GRADE I	TRANSITIONAL	67 (53.2%)
	MENINGOTHELIAL	22 (17.3%)
	MICROCYSTIC	07 (5.7%)
	PSAMMOMATOUS	05 (3.9%)

	ANGIOMATOUS	03 (2.4%)
	FIBROBLASTIC	02 (1.6%)
	SECRETORY	01 (0.8%)
	LYMPHOPLASMACYTIC RICH	01 (0.8%)
	TOTAL	108 (85.7%)
WHO GRADE II	ATYPICAL	14 (11.1%)
	CHORDOID	01 (0.8%)
	TOTAL	15 (11.9%)
WHO GRADE III	ANAPLASTIC	02 (1.6%)
	RHABDOID	01 (0.8%)
	TOTAL	03 (2.4%)

Of the total 85.7% WHO grade I meningiomas, 60.3% cases were in females. The incidence of WHO grade II and WHO grade III meningiomas were less in females as compared to males. Majority of the meningiomas reported in females were WHO grade I. Five female patients (3.9%) had WHO grade II meningioma. Also, the peak age of meningiomas in females was found to be 41-50 years (23, 28.4%), followed by 51-60 years (19, 23.5%) and 31-40 years (17, 21%). All the females in the age group of 41-50 years had WHO grade 1 meningiomas. With increasing age, the incidence of WHO grade II meningioma also increased with 4.9% cases being reported in the age group 51-70 years. WHO grade III meningiomas was not seen in females.

Males, as compared to females, although had a low overall incidence of meningiomas, were found to have a much higher incidence of grade II (10, 7.9%) and grade III meningiomas (03, 2.4%). The peak age of meningiomas in males was found to be 31-40 years (14, 31.2%) followed by 41-50 years (12, 26.8%) and 51-70 years (12, 26.8%). Majority of the males in the age group 31-40 years had WHO grade I meningiomas (12, 26.8%) and 4.4% cases had WHO grade II meningioma. With increasing age, the incidence of WHO grade II meningiomas increased to 15.7% and that of WHO grade III meningiomas rose to 6.6% in patients over 40 years of age.

Recurrence rate of 5.6% (7 cases) was observed in our study. Time range for recurrence was 1-8 years. Majority of these patients were males (male:female = 2.5:1). Five cases of transitional meningioma recurred with the same histomorphological features. However, the other two cases (meningotheliomatous and fibroblastic variant, WHO grade I) had recurred as atypical meningioma, WHO grade II.

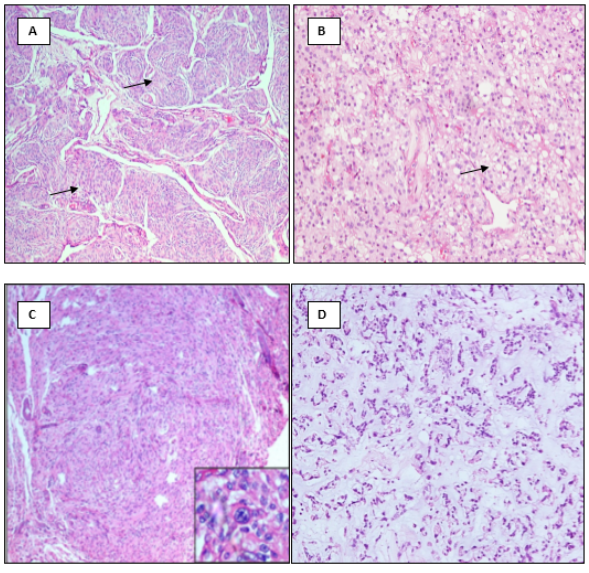

FIGURE 1: (A) Syncytial meningioma, WHO grade I (H&E, x100); (B) Microcystic meningioma, WHO grade I (H&E, x200); (C) Atypical meningioma with sheet like growth, WHO grade II (H&E, x100; inset - increased mitosis, H&E, x400); (D) Chordoid meningioma, WHO grade II (H&E, x100).

Discussion

Meningiomas are slow growing intradural extramedullary tumours which exhibit a wide range of histopathologic appearances which aid in their prognostication and treatment. Meningiomas account for 28-30% of primary central nervous system tumours and constitute 15% of the intracranial tumours and about 25% of the intraspinal tumours (Louis et al., 2007). In the present study of 620 CNS lesions, meningiomas constituted for 20.3% cases, which is largely similar to previous studies by Shah, Mazumdar & Chitale (2005), Ruberti RF (2007) and others (Butt, Khan, Choudrhy & Qureshi, 2005; Lakshmi, 2015; Patty, 2008; Zalata et al., 2011) . The peak incidence is in the middle age group with a noted female preponderance (male:female=1:2) (Claus et al., 2005; Perry & Brat, 2010). Female dominance of meningiomas was confirmed in our study which could be explained due to progesterone dependent tumour growth. Common locations of intracranial or juxtacranial meningiomas include convexity (20–34%); parasagittal and falcine (18–22%); sphenoid and middle cranial fossa (17–25%); frontobasal (10%) and posterior fossa (9–15%) (M. Buetow, P. Buetow & Smirniotopoulos, 1991). Spinal meningiomas are mostly concentrated in the thoracic region with male-to-female ratio of 1:4 (Das, Tang & Smith, 2000). Pediatric meningiomas, although rare, have been described at unusual locations including ventricles, posterior fossa and spinal dural region (Perry & Dehner, 2003). These are usually associated with an aggressive behaviour (Germano, Edwards, Davis, & Schiffer, 1994; Mehta, Bhagwati, & Parulekar, 2009). Our study reported an incidence rate of 4.8% in patients less than 20 years of age which was similar a study by Patil & Sondankar (2016). However, most of these young patients had WHO grade I meningiomas.

Meningiomas show considerable histologic heterogeneity. Thus, histopathologic grading of meningiomas is associated with prognostic and therapeutic implications. About 80% of all meningiomas are slow-growing tumours of WHO grade I (Table 2) (Riemenschneider, Perry & Reifenberger, 2006). The varied histomorpholoigical picture dictates further subytpes of WHO grade I meningiomas. Transitional, meningotheliomatous and fibroblastic meningioma constitute the most common variants (Table 3) (Riemenschneider et al., 2006). The other rare variants include psammomatous, angiomatous, metaplstic, secretory, microcystic and lymphoplasmacytic rich meningiomas, with many case reports describing psammomatous meningioma in the thoracic spine (Lee et al., 2010). In contrast, our study showed fibroblastic meningioma as one of the uncommon variants. WHO grade I meningiomas can invade the dura, dural sinuses, skull, and even extracranial compartments, such as orbit, soft tissue, and skin (Riemenschneider et al., 2006). They have an associated recurrence rate of only 5% (Riemenschneider et al., 2006). Atypical meningiomas constitute 15–20% of meningiomas (Riemenschneider et al., 2006). With an estimated recurrence rate of 40%, atypical meningiomas pose a significant clinical implication (Perry, Scheithauer, Stafford, Lohse & Wollan, 1999; Perry, Stafford, Scheithauer, Suman & Lohse, 1997) Anaplastic meningiomas account for 1–3% of all meningioma cases ((Riemenschneider et al., 2006). They are widely infiltrative, form metastatic deposits and have a high recurrence rate of upto 50-80% (Perry et al., 1999). However, we observed recurrence in WHO grade I meningiomas only. This could probably be due to loss of patients to follow up or less survival rates associated with high grade meningiomas. Atypical and anaplastic meningiomas are more frequently evidenced in males (Jääskeläinen, Haltia & Servo, 1986). Although the explanation is lacking, however, the differences in hormone levels, hormone receptor status and sex chromosome genetic variation might provide some understandings in this tumour biology.

TABLE 2: Comparison of incidence of WHO grades of meningioma

Study	WHO Grade I	WHO Grade II	WHO Grade III
Lakshmi, 2015 (n=128)	90.63%	7.03%	2.34%
Desai & Patel, 2016 (n=50)	90%	8%	2%
Patil & Sondankar, 2016 (n=87)	87.36%	8.04%	4.6%
Moradi et al., 2008 (n=378)	87.1%	10.8%	2.1%
Samadi & Ahmadi, 2008 (n=238)	86.1%	8%	5.9%
Present study (n=126)	85.7%	11.9%	2.4%

TABLE 3: Comparison of incidence of histological subtypes of meningioma

Study	Transitional	Meningothelial	Fibroblastic	Psammomatous
Grondahl, Moen & Trop, 2012 (n=196)	40%	17%	7%	-
Lakshmi, 2015 (n=128)	15.6%	23.4%	23.4%	21.8%
Patil & Sondankar, 2016 (n=87)	24.1%	43.7%	5.7%	10.3%
Desai & Patel, 2016 (n=50)	-	68.1%	6.8%	2.3%
Moradi et al., 2008 (n=378)	32.6%	33.7%	13%	1%
Present study (n=126)	53.2%	17.3%	1.6%	3.9%

Limitations to the study:

This is a retrospective study and thus prone to all the limitations of data collection essential to this study design. It is a single institution based study restricted by small sample size. Our population may not be completely representative of the entire meningioma population.

Conclusion

Meningiomas are slow growing neoplasms arising from the arachnoidal cap cells and more common in females. They exhibit a wide spectrum of histopathological appearances which aid in its prognostication and treatment. The majority are WHO grade I meningiomas and are readily curable by resection. Fibroblastic meningiomas constituted one of the rare variants. Recurrence was limited to WHO grade I meningiomas, however, this is largely controversial. This study aims to provide an overview of various histological variants of meningiomas.

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