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Original Article

Pathology Section

Histopathological Study of Central Nervous System Lesions: Emphasizing Association of Neoplasms with ABO Blood Groups

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ABSTRACT

Introduction: The Central Nervous System (CNS) lesions show considerable geographic and racial variations with respect to the incidence and the pattern of distribution of lesions. The ABO blood status is a readily accessible factor in genetic constitution of the patients. It has been shown to be associated with many diseases. But the influence of blood group status on the pathogenesis of brain tumours is still unclear.

Aim: To study various histopathological patterns of CNS lesions and to evaluate the association of CNS tumours with the distribution of ABO blood groups in documented cases.

Materials and Methods: In the present study, 147 cases were analyzed. It was an analytical type of study, done at JSS Medical College, Mysore, over a period of 2 years and 8 months from January 2009 to August 2011. Histopathology slides were routinely stained by Haematoxylin and Eosin (H&E) stain. Special stains were performed in selected cases. Blood group of the patients and the control group were documented. Blood group distribution pattern was assessed in relation to histopathological diagnosis of various CNS tumours.

Results: Histopathological diagnosis of 147 cases included neoplastic lesions (84.35%) and non-neoplastic lesions (15.64%). Neoplastic lesions (84.35%) constituted the majority, which included neuroepithelial tumours (29.25%) as predominant pattern. Non-neoplastic lesions constituted only 15.64%, which included inflammatory lesion (8.16%) as the predominant pattern. ABO blood group data was available in 92 cases (84.4%) of neoplastic lesions, which included 71 cases (48.29%) of primary CNS neoplasms categorized according to WHO grades. The control group constituted 21,067 healthy voluntary donors. Blood group O was the most frequent blood group in neoplastic lesions (40.21%) and primary CNS neoplasms categorized according to WHO grades (45.07%). The association between the CNS neoplasms and ABO blood groups was not statistically significant (p = 0.055). But a definite change in the pattern of distribution of ABO blood groups observed between neoplastic lesions and control groups.

Conclusion: The influence of blood group types on the development of brain tumours appears intriguing and needs to be well established. Though statistically insignificant, a definite change in the pattern of distribution of ABO blood groups was observed between neoplastic lesions and control groups. This necessitates attention and stratification of patients for effective management.

Keywords: Brain tumours, Donors, Neuroepithelial tumours

INTRODUCTION

CNS lesions are known to mankind since 1774. Earlier, it was often stated that brain tumours were uncommon in Indians. With the development of recent investigative techniques in India, it has become obvious that the brain tumours are as common in this country as elsewhere [1].

Systemic study of tumours of the CNS began when Baily and Cushing started their studies in the early 1920s. Many reports suggested that both incidence and pattern of intracranial neoplasia are subject to considerable geographic and racial variations. The knowledge of the regional peculiarities of these lesions would therefore, help in identifications of possible risk factors. It also helps in establishing measures for an improved diagnosis, treatment and outcome [2].

The ABO blood group status is a readily accessible factor in genetic constitution of the patients. It has been shown to be associated with many diseases. But the justification for the association of ABO blood type with some disease has not been still elucidated. ABO blood group genes are localized at 9q34.2 region, where the genetic alteration is commonly identified in many cancers. In various human malignancies, such as colon cancer, breast cancer and prostate cancer, a correlation of blood group antigen expression in tumour with metastasis and prognosis has been reported. The possible reason could be the expression of blood group carbohydrates on cell surface of metastatic cancer cells, which functions as cell adhesion molecules [3]. The influence of blood group types on pathogenesis of brain tumours is still unclear, as there are conflicting reports from studies done on the distribution of ABO blood groups in primary intracranial neoplasms [4].

The present study was undertaken to study the various patterns of CNS lesions in histopathology and to evaluate the association of CNS neoplasms with the distribution of ABO blood groups in documented cases.

MATERIALS AND METHODS

The study was conducted at histopathology and blood bank sections in the Department of Pathology at JSS Medical College, Mysore, India. It was an analytical type of study done over a period of 2 years and 8 months from January 2009 to August 2011. One hundred and forty-seven cases were analysed.

All neurosurgical cases for which histopathological examination were performed were included in the study. Those neurosurgical cases for which samples were inadequate for interpretation, those cases in which histopathological examination did not yield conclusive results

and could not be followed up; and those cases in which tissues sent were not from the lesions of central nervous system or its coverings were excluded from the study.

Tissue specimens received from neurosurgery were subjected to histopathological examination. After routine grossing, tissues were processed by standard procedure and routinely stained by Haematoxylin and Eosin. Special stains {Periodic Acid Schiff (PAS), reticulin stains} were employed in selected cases. The histological characterisation of CNS tumours was done according to the 2007 WHO classification. Available clinical details and ABO blood type of the patients were collected and recorded according to the proforma. The control group constituted healthy voluntary blood donors. The pattern of distribution ABO blood group in patients having CNS lesions was compared with that of the control group. Emphasis was given to assess the association between neoplastic CNS lesion and ABO blood group.

STATISTICAL ANALYSIS

Frequencies, Chi-Square Test and Crosstabs (Contingency coefficient test) were used for calculation. All the statistical calculations were done through SPSS 16.0 for windows.

RESULTS

CNS lesions were observed in all age groups ranging from four-day-old baby to 88 years. The lesions were common in seventh decade with a mean of 42.97%. The distribution of neoplastic lesion in seventh decade was statistically significant ($p<0.05$). The lesions were slightly predominant in males with a male to female ratio of 1.01:1. CNS lesions were more common in the intracranial region (82.31%) than in the spinal cord region (17.68%). Frontal region (17%) was the most common intracranial site of involvement. Cervical region (3.4%) was the most common site of involvement in spinal cord region.

Out of 147 cases, 124 cases (84.35%) were neoplastic lesions, constituting the majority and 23 cases (15.64%) were non-neoplastic lesions. The distribution of various neoplastic and non-neoplastic CNS lesions is depicted in [Table/Fig-1]. Among neoplastic lesions, neuroepithelial tumours (29.25%) constituted the most common tumour and germ cell tumour (0.6%) constituted the least common tumour.

Primary CNS neoplasms were categorized according to WHO grades and constituted 99 cases (79.83%). Grade I tumours (54 cases, 54.55%) were the most common tumours, followed by Grade IV tumours (20 cases, 20.2%) and Grade II (15 cases, 15.15%). Grade III tumours (10 cases, 10.1%) constituted the least common primary tumours. Among non-neoplastic lesions, inflammatory lesions (8.16%) constituted the most common pattern and vascular lesion (0.6%) constituted the least common lesion.

Out of 147 cases, ABO blood group data was available in 109 cases (74.14%) which included 92 cases (84.40%) of neoplastic lesions and 17 cases (15.59%) of non-neoplastic lesions. The data was available in 71 cases (48.29%) of primary CNS neoplasms that were categorized according to WHO grades. The pattern of distribution of ABO blood groups in neoplastic lesions were compared with that of the control group. The control group constituted 21,067 healthy voluntary blood donors.

The pattern of distribution of ABO blood groups in neoplastic lesions is depicted in [Table/Fig-2]. In the control group, blood group O was the most frequent blood group, followed by B, A and AB. Neoplastic lesions were most common in patients with blood group O, followed by A, B and AB. Neuroepithelial tumours, meningeal tumours and cranial and paraspinal nerve tumours were common in blood group O patients. But metastatic tumours and lymphoma followed a different pattern of distribution and were seen in patients with blood group A and blood group B. These observations indicate

S. No.	CNS LESIONS	CASES (n =147)	Percent
	NEOPLASTIC LESIONS	124	84.35%
1	NEUROEPITHELIAL TUMOURS	43	29.25%
A	Astrocytomas	30	20.40%
	Pilocytic astrocytoma	03	2.04%
	Gemistocytic astrocytoma	01	0.6%
	Fibrillary astrocytoma	06	4.08%
	Anaplastic astrocytoma	05	3.40%
	Glioblastoma	13	8.84%
	Gliosarcoma	02	1.36%
B	Oligodendroglial Tumours	03	2.04%
	Oligodendroglioma	01	0.6%
	Anaplastic oligodendroglioma	02	1.36%
C	Oligoastrocytic Tumours	05	3.40%
	Oligoastrocytoma	02	1.36%
	Anaplastic oligoastrocytoma	03	2.04%
D	Embryonal Tumours	05	3.40%
	Medulloblastoma	04	2.72%
	Primitive neuroectodermal tumour	01	0.6%
2	MENINGIAL TUMOURS	34	23.12%
	Meningotheiomatous	16	10.88%
	Fibroblastic	03	2.04%
	Transitional	03	2.04%
	Atypical	04	2.72%
	Angiomatous	01	0.6%
	Psammomatous	01	0.6%
	Metaplastic	01	0.6%
	Haemangioma	03	2.04%
	Haemangiopericytoma	01	0.6%
	Haemangiobastoma	01	0.6%
3	CRANIAL AND PARASPINAL NERVE TUMOURS	20	13.60%
	Schwannoma	18	12.24%
	Neurofibroma	02	1.36%
4	PITUITARY NEOPLASMS	11	7.48%
5	METASTATIC TUMOURS	08	5.44%
	Adenocarcinoma	07	4.76%
	Squamous cell carcinoma	01	0.6%
6	SELLAR TUMOURS	05	3.40%
	Craniopharyngioma	05	3.40%
7	LYMPHOMA AND HAEMOPOETIC TUMOURS	02	1.36%
	Non-Hodgkins lymphoma	02	1.36%
8	GERM CELL TUMOUR	01	0.6%
	Mature teratoma	01	0.6%
	NON NEOPLASTIC LESIONS	23	15.64%
1	INFLAMMATORY LESIONS	12	8.16%
	Chronic non-specific inflammation	05	3.40%
	Abscess	05	3.40%
	Acute inflammatory lesion	01	0.6%
	Tuberculoma	01	0.6%
2	CYSTIC LESIONS	07	4.76%
	Epidermoid cyst	04	2.72%
	Arachnoid cyst	01	0.6%
	Ratkes cyst	01	0.6%
	Parasitic cyst	01	0.6%
3	HERNIATION/NEURAL TUBE DEFECTS	03	2.04%
	Meningocoele	01	0.6%
	Meningomyeocoele	01	0.6%
	Meningoencephalocoele	01	0.6%
4	VASCULAR LESIONS	01	0.6%
	Arterio – venous malformation	01	0.6%

[Table/Fig-1]: Distribution of central nervous system lesions.

a definite change in the pattern of distribution of ABO blood group. The association between the ABO blood groups and neoplastic lesion was not statistically significant (p = 0.055). But the p-value appears to be very close to the significance.

Non-neoplastic lesions were most common in blood group O patients [Table/Fig-2]. The association between the ABO blood groups and non-neoplastic lesion was not statistically significant (p>0.05).

In the category of primary CNS neoplasms which were categorized according to WHO grades, blood group O was the most common blood group in patients with WHO grade I, WHO grade II and WHO grade III tumours. However, a definite change in pattern of distribution was seen in WHO grade IV tumours, in which blood group B was most common. But the association between primary CNS neoplasms which were categorized according to WHO grades and ABO blood groups was not statistically significant (p>0.05). The distribution of ABO blood groups in Primary CNS neoplasms categorized according to WHO grades is depicted in [Table/Fig-3].

DISCUSSION

Various histopathological patterns of CNS lesions were encountered in the present study. Butt ME et al., observed CNS lesions commonly in third to fifth decade in their study [2]. CNS lesions were commonly seen in the third decade in a study conducted by Rathod V et al., [1]. In contrast to other studies, the CNS lesions showed clustering in seventh decade and were statistically significant for neoplastic lesions. Rathod V et al., Butt ME et al., and the present study documented male predominance in the studies [1,2]. The distribution pattern of various space occupying lesions of CNS of the present study was compared with other studies. Similar to the present study, Rathod V et al., and Butt ME et al., observed that neoplastic lesions were more common than non-neoplastic lesions [1,2]. Rathod V et al., Butt ME et al., Nibhoria S et al., and Jat KC et al., observed that among the neoplastic lesions, neuroepithelial tumours were the commonest neoplastic lesion followed by meningeal tumours [1,2,5,6]. Similar to above studies, even in the present study, neuroepithelial tumours were the commonest neoplastic lesion. In contrast Ghanghoria S et al., documented meningeal tumours as most common neoplastic lesion in their study [7]. Among the non-neoplastic lesions, similar to the present observation, inflammatory lesion were the predominant pattern in the studies conducted by Rathod V et al., and Butt ME et al., [Table/Fig-4] [1,2].

The number of cases of neoplastic lesion in which blood groups were documented was much more than that of non-neoplastic lesions. Hence the emphasis was given to the association between neoplastic lesions and ABO blood group. The pattern of distribution of ABO blood groups in various CNS neoplasms were studied and compared with other studies.

Periyavan S et al., observed that blood group O was common in most of the category of CNS lesions {neuroepithelial tumours (38.45%), meningeal (37.57%), cranial and paraspinal nerve tumours (39.67%), pituitary neoplasms (43.62%) and metastatic tumours (43.18%)} [8]. But haematopoeitic tumours were seen in patients with A, B, and O blood groups constituting 33.33% each. Mehrazin M et al., observed meningeal tumours (35.90%) and sellar tumours (50%) more frequently affecting patients with blood group A [4]. Neuroepithelial tumours (38.46%), cranial and paraspinal nerve tumours (35.90%) and pituitary neoplasms (42.40%) were seen more frequently in O blood group patients in their study. In contrast to other studies, Strang RR et al., documented that astrocytomas were common in blood group A patients [9]. Akca Z et al., also observed glioblastomas most commonly in blood group A patients [10]. Gharouni M et al., found haematopoetic tumours more frequently in O blood group

Cases	Blood Groups Documented	ABO Blood Groups							
		A	%	B	%	AB	%	O	%
Control Population	21067	5342	25.35%	5626	26.70%	1283	6.09%	8816	41.84%
CNS Neoplasms									
Neoplastic Lesions	92 (84.40%)	30	32.60%	23	25%	2	2.17%	37	40.21%
Neuroepithelial tumours	33	7	21.21%	10	30.30%	1	3.03%	15	45.45%
Meningial tumours	26	8	30.76%	7	26.92%	0	0%	11	42.30%
Cranial and paraspinal nerve tumours	10	4	40%	0	0%	1	10%	5	50%
Pituitary neoplasms	9	4	44.44%	1	11.11%	0	0%	4	44.44%
Metastatic tumours	7	4	57.14%	3	42.85%	0	0%	0	0%
Sellar tumours	4	2	50%	0	0%	0	0%	2	50%
Lymphoma and haemopoetic tumours	2	1	50%	1	50%	0	0%	0	0%
Germ cell tumour	1	0	0%	1	100%	0	0%	0	0%
Non-Neoplastic	17 (15.59%)	5	29.41%	5	29.41%	0	0%	7	41.17%
Inflammatory lesions	9	1	11.11%	3	33.33%	0	0%	5	55.55%
Cystic lesions	6	2	33.33%	2	33.33%	0	0%	2	33.33%
Neural tube defects	2	2	100%	0	0%	0	0%	0	0%

[Table/Fig-2]: Distribution of ABO blood groups in CNS lesions.

Cases	Number of Cases	Blood Groups Documented	ABO Blood Groups							
			A	%	B	%	AB	%	O	%
Control Population	21067	21067	5342	25.35%	5626	26.70%	1283	6.09%	8816	41.84%
Primary CNS Neoplasms Categorized According to WHO Grades										
Grade I	54 (54.55%)	35 (64.81%)	13	37.14%	6	17.14%	1	2.85%	15	46.87%
Grade II	15 (15.15%)	12 (80%)	1	8.33%	2	16.66%	0	0%	9	75%
Grade III	10 (10.1%)	8 (80%)	3	37.50%	2	25%	0	0%	3	37.50%
Grade IV	20 (20.2%)	16 (80%)	4	25%	6	37.5%	1	6.25%	5	31.25%
TOTAL	99	71 (71.71%)	21	29.57%	16	22.57%	2	2.81%	32	45.07%

[Table/Fig-3]: Distribution of ABO blood groups in primary CNS neoplasms categorized according to WHO grades.

SLNO	CNS LESIONS	Present Study	Percentage	Butt ME et al.,[2]	Percentage	Rathod V et al.,[1]	Percentage	Ghanghoria S et al.,[7]	Percentage	Nibhoria S et al.,[5]	Percentage	Jat KC et al.,[6]	
	NEOPLASTIC LESIONS	124	84.35%	88	88%	28	53.84%	65	100%	89	100%	59	100%
1	Neuroepithelial tumours	43	29.25%	41	41%	16	30.76%	26	40%	46	51.7%	40	67.79%
2	Meningial tumours	34	23.12%	23	23%	5	9.61%	29	44.61%	31	34.8%	13	22.03%
3	Cranial and paraspinal nerve tumours	20	13.60%	11	11%	1	1.9%	5	7.69%	4	4.5%	2	3.38%
4	Pituitary neoplasms	11	7.48%	2	2%	2	3.84%	0	0%	0	0%	0	0%
5	Metastatic tumours	8	5.44%	6	6%	3	5.76%	0	0%	5	5.6%	1	1.69%
6	Sellar tumours	5	3.40%	0	0%	0	0%	4	6.15%	2	2.3%		
7	Lymphoma and haemopoetic tumours	2	1.36%	1	1%	0	0%	0	0%	1	1.1%	1	1.69%
8	Germ cell tumours	1	0.6%	1	1%	0	0%	0	0%	0	0%	2	3.38%
9	Pineal tumours	0	0%	0	0%	1	1.9%	0	0%	0	0%	0	0%
10	Other tumours	0	0%	3	3%	0	0%	1	1.54%	0	0%	0	0%
	NON NEOPLASTIC LESIONS	23	15.64%	12	12%	24	34.61%	0	0%	0	0%	0	0%
1	Inflammatory lesions	12	8.16%	7	7%	10	19.23%	0	0%	0	0%	0	0%
2	Cystic lesions	7	4.76%	2	2%	6	11.53%	0	0%	0	0%	0	0%
3	Herniation/neural tube defects	3	2.04%	0	0%	0	0%	0	0%	0	0%	0	0%
4	Vascular lesions	1	0.6%	3	3%	8	15.38%	0	0%	0	0%	0	0%
	Total cases	147		100		52		65		89		59	

[Table/Fig-4]: Comparison of distribution of central nervous system lesions.

Authors		Most Common Blood Group	Second Frequent Blood Group	Third Frequent Blood Group	Least Common Blood Group	Total Cases
Periyavan S et al., [8]	CONTROL	O (39.80%)	B (29.83%)	A (24%)	AB (6.34%)	21233
	NEOPLASMS	O (41.81%)	B (29.16%)	A (22.35%)	AB (6.65%)	1937
Mehrazin M et al., [4]	CONTROL	O (36.40%)	A (32.40%)	B (23.30%)	AB (7.80%)	-
	NEOPLASMS	O (35.40%)	A (32.70%)	B (23.30%)	AB (8.60%)	907
Akthar K et al., [3]	CONTROL	B (40.50%)	O (29.50%)	A (18.60%)	AB (11.40%)	2640
	NEOPLASMS	B (56.10%)	A (31.30%)	O & AB (6.30%)	-	112
Akca Z et al., [10]	CONTROL	A (45%)	O (31%)	B (16%)	AB (8%)	17314
	NEOPLASMS	A (46%)	O (32%)	B (12%)	AB (10%)	72
Present study	CONTROL	O (41.84%)	B (26.70%)	A (25.35%)	AB (6.09%)	21067
	NEOPLASMS	O (40.21%)	A (32.60%)	B (25%)	AB (2.17%)	92

[Table/Fig-5]: Comparison of pattern of distribution of ABO blood groups in CNS Neoplasms.

patients [11]. Abouzani M et al., found secondary CNS lymphomas most commonly in O blood group patient and significantly low in patients with blood group A [12]. In the present study, blood group O was most common in most of the category of lesions except for metastatic lesions and haematopoietic tumours. Metastatic tumours and haematopoeitic tumours were seen in patients with blood group A and B.

The pattern of distribution of ABO blood groups in neoplastic CNS lesions was compared with that of the control groups. There was no change in pattern of distribution of ABO blood groups between neoplastic lesions and control groups in the study conducted by Mehrazin M et al., Periyavan S et al., and Akca Z et al., [4,8,10]. In contrast, the present study and Akthar K et al., observed a change in the pattern of distribution of ABO blood groups between neoplastic lesions and control groups [Table/Fig-5] [3].

Periyavan S et al., and Akca Z et al., also found no association between ABO blood group and neoplastic lesion [8,10]. This may be because, most of the studies followed similar sampling method to select the control population. On the contrary, Akhtar K et al., found significantly higher association between brain tumours and blood group B [3]. This was probably because there was relatively less difference in the number of cases between the control group (2640) and the study group (112) when compared to the above studies.

In the present study, even though the p-value (p=0.055) was very close to significance for neoplastic lesions, the association between the ABO blood groups and neoplastic lesions or primary CNS tumours categorized according to WHO grades was not statistically significant. This is because the sample size of control group was much higher than that of the study group. But the change in the pattern of distribution of ABO blood groups between neoplastic lesions and control groups was quiet obvious. A modification in statistical method for selecting control group may be suggested for future studies of such kind, thereby, minimising the vast difference in number between the control group and study group.

However, various studies have found association between different neoplastic CNS lesions and particular ABO blood group. A significant association has been found between craniopharyngioma [4], astrocytomas [13-15], meningiomas [16] and blood group A. Significantly higher frequency of medulloblastoma was found in patients with blood group B [15].

Different manifestations of a disease may be quiet often associated with different blood groups. From the association of blood groups with various cancers, it appears that there may be an inherited

element in the protection against different types of cancers or the susceptibility to a particular malignancy. The racial and ethnic distribution of blood group type plays an important role in predicting the risk of developing cancer. Hence the identification of genetic makeup and environmental factors among the racial and ethnic groups would provide some insights into the observations made in epidemiological data. This may provide opportunities to understand the tumourigenesis and may thus help in proper management of the cancer patients [3].

Anderson DE and Haas C were the first to explore the possibility of association between ABO blood type and malignancy [17]. The underlying mechanisms which govern the association between ABO blood type and cancer still needs to be elucidated. One probable explanation is that the ABO blood type may regulate several proinflammatory and adhesion molecules (soluble E select in and intercellular adhesion molecule -1). This may play an important role in tumourigenesis [18]. The laboratory investigations have provided several possible mechanisms to explain the association of ABO blood groups and cancer. The suggested mechanisms involve immune surveillance for malignant cells, membrane signaling, intercellular adhesions and inflammation. A variety of tumours show altered expression of ABO antigen on the surface of cancer cells in comparison with normal epithelial cell. Glycoconjugates are the key mediators of membrane signaling and intercellular adhesion, immanent to the malignant progression and metastasis. These surface molecules may confer immunesurveillance for cancer cells [19].

The association between brain tumours and blood group antigens is variable. No Specific hypothesis has been proposed for the association between CNS neoplasms and ABO blood groups. The above mentioned mechanisms may operate even in the CNS neoplasms. We propose a probable hypothesis that, an alteration in the characteristics of ABO blood group antigens on the surface of cell of origin, under the influence of either environmental factors or genetic factors may govern the process of development of tumours. This mechanism may operate in both the primary neoplastic lesions and metastatic lesions of the CNS in the genetically susceptible individuals.

In cases of glioblastoma multiforme with venous thromboembolism, greater morbidity and mortality were found to be associated with blood group A and AB in comparison to the patients of blood group O. The epidermal growth factor receptor (EGF-R), which is associated with malignant grade of gliomas is found more frequently on the endothelial cells of tumours from blood group A patients with therapeutic implications [8].

Simrad TJ et al., observed that incidence of Venous Thromboembolism (VTE) in patients of glioma were very high, particularly in the first six months after diagnosis and especially after major neurosurgery [20]. The study conducted by Streiff MB et al., suggested that AB blood group type is a previously unrecognized and potent risk factor for the development of thrombosis in malignant glioma patients [21]. According to the documented evidence, this finding is congruous with modern concepts of haemostasis. ABO blood group status has a very intense influence on the serum levels of factor VIII activity and von Willebrand Factor (vWF). The lowest serum levels of these factors have been associated with O blood group, highest levels with AB blood group and intermediate serum levels with blood groups A and B [21]. Individuals of non-O blood group status have 25% higher plasma levels of vWF and Factor VIII when compared to O blood group individuals. The ABH antigenic structures present on circulation regulates the activity of this protein through varying degrees of glycosylation. vWF which is an important modulator of angiogenesis and apoptosis influences the onset of neoplastic diseases in non-O blood group individuals [18].

Increased level of factor VIII, stabilized by vWF, increases the risk of initial and recurrent VTE by four to six-fold. Even though the direct association between the risk of thrombosis in glioma patients and serum factor VIII activity remains to be established, ABO blood type is an efficacious marker for this association. Unlike previously recognized markers of VTE risk, ABO blood group status is determined routinely preoperatively by standardized methods and objective methods. It would be easily available to guide early decision making regarding prophylaxis of VTE. The study also suggested that ABO blood group antigens may play a role in the pathogenesis of thrombosis in patients with gliomas and other malignancies, possibly through interactions with known procoagulant proteins [21]. The association of certain blood group with higher grade tumours may necessitate preoperative vigilance and prophylactic management of the patients at risk.

LIMITATION

The limitation of the present study is the sampling method followed to select the control population. All the voluntary donors documented during the study period were included under the control group. The selection of control population was based on the sampling method followed by previous studies. This resulted in a huge difference between the study population and control population.

CONCLUSION

The influence of ABO blood group on the development of brain tumours appears intriguing and needs to be well established. Though statistically insignificant, a definite change in the pattern of distribution of ABO blood groups was observed between neoplastic lesions and control groups. This necessitates attention and stratification of patients for effective management. Based on the observations of the study, it may be suggested that ABO blood group may be associated with primary CNS neoplasms and metastatic lesions. Probable hypothesis can be proposed that an alteration in the characteristics of ABO blood group antigens on the surface of cell of origin, under the influence of either environmental factors or genetic factors may govern the process of development of tumours. This mechanism may operate in both the primary neoplastic lesions and metastatic lesions of the CNS in the genetically susceptible individuals. A modification in statistical method for selecting control group may be suggested for future studies of such kind, thereby minimising the vast difference in number between the control group and the study group. In view of conflicting reports, more focused studies including the molecular studies are indicated.

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