SYSTEMATIC REVIEW ON RELATIONSHIP OF NEUROLOGICAL TUMORS WITH ABO BLOOD

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ABSTRACT

Background: ABO blood type markers are present on the cell membranes of epithelial and endothelial layers, as well as on nerve cells. Numerous studies have highlighted a correlation between the risk of developing certain cancer types and ABO blood group antigens. Risk factors like smoking, alcohol consumption, diet, and radiation exposure play a significant role. Neuroma, a benign tumor of nerve tissue, is often associated with pain or various other specific symptoms. It typically develops from non-neuronal nervous tissue following amputation or trauma, though it can also be a true neoplasm. Approximately 6% of individuals may develop a neuroma. Aim and Objective: The main goal of this research was to analyze existing studies and Exploring the correlation between blood types and brain tumors. Material and Methods: Original, relevant, and up-to-date articles in the same field were reviewed to provide a comprehensive analysis of this topic. In doing so, critical discussions were included, offering not just a descriptive overview but also a thorough presentation of contradictory viewpoints in a clear manner. Research queries were carried out by matching terms associated with blood groups and tumors of the nervous system. Result: People with blood group B showed an increased incidence of cavernomas, gliomas, meningiomas, pituitary adenomas, schwannomas, and other tumors, with a declining trend in prevalence across blood type O, A, and AB. The link between blood type O and neuroma was the sole correlation to reach statistical significance. The likelihood of glioma was greater among individuals with AB blood type regarding other ABO blood types. Those with blood type A were more susceptible to developing glioblastoma compared to individuals with blood type O. Conclusion: It was determined that no meaningful correlation existed between blood group antigens and brain neoplasms in the general population. While neuroma showed a distinct association with blood group O, its occurrence in the population is relatively rare.

KEYWORDS: Brain tumors, Neuroma, Glioma, Blood types.

INTRODUCTION

Tumors are a major contributor to global mortality rates. A large portion of research is committed to investigating potential risks for these cancers, like tobacco use, Alcohol intake, dietary habits, excess weight, microbial diseases, toxic environmental agents, and contact with radiation. Hereditary factors, including ABO blood groups, were also recognized, along with genetic mutations associated with a higher likelihood of tumors (1).

The ABO blood type system, identified by whether A and B antigens are present or lacking on red blood cells, was identified by Karl Landsteiner in 1900. These antigens are intricate carbohydrate formations found on erythrocyte membranes (2).

These ABO blood type markers indicate unique phenotypes and genetically encoded carbohydrate-protein structures located on the outer layer of red blood cell membranes, actively involved in cellular functions and disease processes. The specific oligosaccharide structures of the antigens define the blood type. Consequently, secondary gene products correspond to blood group antigens, while primary gene products are diverse glycosyltransferases involved in oligosaccharide chain synthesis.

In certain blood groups, the absence of antigens has sparked debate regarding the relationship between susceptibility for particular infectious and noninfectious conditions and the ABO blood type. In certain blood types, the existence or lack of antigens leads to changes in the blood membrane's structure and function. The structure of blood types influences their functions, linking blood groups to both diseases and overall health (3). Besides blood group markers and red blood cells,

they may also be found on particular tissues, leukocytes, thrombocytes, plasma-derived proteins, and various membrane-bound enzymes (4). ABO blood type markers can also appear in bodily fluids like perspiration, oral fluid, and human milk, semen, urine, gastric liquid, and amniotic sac fluid in a dissolved state (4).

The most frequent primary symptom in individuals experiencing peripheral traumatic neuromas (5) in the affected area, it can result in pain, tingling, as well as sensory and motor deficits (6). Gliomas, meningiomas, and pituitary adenomas are the most frequent forms regarding brain tumors. Glioma is leading category of primary brain tumor. According to histological features, gliomas are categorized into the following subtypes: glioblastoma, Astrocytic tumor, Oligodendrocyte tumor, Ependymal tumor, combined glioma, and aggressive glioma. Annually, about 100,000 individuals are diagnosed with glioma worldwide. It represents less than 2% of all new cancer diagnoses and is associated with high rates of death and illness.

As per the World Health Organization's classification, glioblastoma is most aggressive glioma, designated as a grade 4 tumor, and makes up 50% of all gliomas.[7]

Numerous studies have produced inconsistent results regarding link among ABO blood types along with glioma susceptibility. Effect of blood types on brain tumors formation Persists uncertain due to the conflicting findings from research on ABO blood type distribution and glioma risk (7).

Despite the contradictory findings, certain ABO blood types have been associated with brain tumors. For instance, Individuals with blood type A may face a higher chance of developing astrocytoma, glioblastoma, and craniopharyngioma. Nevertheless, a study involving 107,472 participants found no correlation between blood type A and gliomas. On the other hand, blood type B was the most common ABO group 56.1% in Neurogenic tumors at a prominent in India. Additionally, Grade IV was more prevalent in individuals with blood type B among glioblastoma multiforme cases, though one study found no correlation, while another considered non-O blood types as an isolated adverse prognostic indicator (8).

Incidence rates are typically greater in highly developed nations compared to less industrialized regions. The five most frequently observed tumors were astrocytic tumors 47.3%, posterior fossa tumors 11.4%, Rathke's pouch tumors 9.7%, ependymal neoplasms 4.8%, and Schwann cell tumors 4.1%. Glial cell tumors represent the most common form of primary brain tumor, comprising roughly 27% of all brain tumors and nearly 80% of malignant cases. These tumors originate from glial cells or their precursor forms and include astrocytic tumors, glioblastomas, oligodendroglial tumors, ependymal neoplasms, mixed glial tumors, high-grade glial tumors, and several rare histological subtypes. The precise cause of glial tumors remains unclear (9).

METHODOLOGY

The present review is held under the guidance of meta-analysis and systemic review for preferred items.

Research criteria: Authentic and current studies on the same topic existed examined along with helped form a detailed overview of this topic. The search of 43 articles, time duration 1956-2023 was performed from Pub Med, Scopus, Wave of science, Medline etc. Therefore, these discussions include not only a detailed overview of the topic but also opposing viewpoints, which were thoroughly explored and presented in a clear manner. Additionally, pertinent scientific studies from prior years were also included. The literature search concentrated on blood groups and associated conditions. The studies were evaluated and selected according to the title and summary. The key words are Blood groups, neurological tumors, neuroma, glioma, which has been extracted from the articles itself. These keywords were helpful in search purpose.

Study selection: Studies were chosen according to defined inclusion and exclusion criteria.

Selection criteria: This study is particularly on brain tumors and its relation to ABO blood group system was included.

Exclusion criteria: All the articles which not include the ABO blood type and brain tumors.

As per all the articles, procedure prior to performance of any type of brain tumors and related conditions. Significance to the ABO blood group system.

RESULT

Connection among ABO blood group antigens along with Brain neoplasm prevalence has occurred studied for a long time, (10) No defined hypothesis has been advanced concerning that relationship among ABO blood groups together with central nervous system Tumors. The researchers Kumarguru et al. proposed a reasonable hypothesis, suggesting that environmental or genetic factors could influence the characteristics of blood type System markers on outer layer of originating cells, possibly affecting tumor formation. Under this context, the process may function not solely in primary tumor growths but also in metastatic abnormalities of the central nervous system in individuals with a genetic predisposition (11). The impact of blood group categories on brain tumor development remains unclear. Periayavan

S. et al. noted that central nervous system lesions were most commonly associated with blood group O, including meningeal lesions 37.57%, neuroepithelial tumors 38.45%, pituitary tumors 43.62%, Cranial and spinal nerve neoplasms accounted for 39.67%, while metastatic tumors represented 43.18%.

Mehrazin M et al. noted that head and spinal nerve tumors 35.9%, neuroepithelial tumors 38.4%, and pituitary tumors 4.40% occurred more often observed within patients with blood type O under their research (12).

Several earlier studies have examined the prevalence of blood type ratios within glioma individuals. Yates and Pearce carried out the first investigation into the connection between ABO blood types along with glioma probability, finding no significant association in patients diagnosed before 1945. An Italian case-control research involving 195 histologically verified gliomas cases revealed an affirmative correlation to blood type A, specifically Campbell et al. found that, When low-grade astrocytic tumors were analyzed individually, the prevalence of glial tumors was significantly higher among individuals with blood type O compared to the general population (13).

Mehrazin et al., in their retrospective study, No significant variations detected in intracranial tumor types along with proportion of four blood types. Conversely, Akhtar et al., through A comparative study of 112 brain and spinal cord tumors identified a markedly stronger link between such tumors and patients possessing blood type B (14-15). Akca et al. conducted an observational study aiming to evaluate glioblastoma multiforme patients using control groups to study ABO blood group distribution. These findings revealed no notable differences between blood types O, A, B, and AB. Similarly, Turowski along with Czochra analyzed ABO blood type distribution within 271 glioblastoma multiforme patients, using a sample of 500 control individuals with traumatic brain injury. Consequently, a statistically relevant variation existed noted within the frequency of ABO blood types among these individuals. Additionally, Patients with glioblastoma multiforme showed a higher frequency of blood type A and a lower frequency of blood type O (16).

Another investigation involved 2,077 histologically verified glioma cases admitted to the hospital between 2001 and 2016, alongside a control cohort of 2,716 non-tumor patients from the same institution. The results demonstrated a significant association between blood groups B and AB and the likelihood of glial tumor development. Nevertheless, a long-term study tracking more than 100,000 adults in the U.S. for almost 20 years found no substantial differences in glioma risk associated with ABO blood groups. As a result, the study concluded that ABO blood type likely does not affect glioma development (7, 37).

Nevertheless, the impact of blood group types on glioma development remains uncertain.

As reported by Gopal K. Patidar, Yashaswi Dhiman, and Anjali Hazarika, glioma was more common in male individuals blood type O 35.49% compared with blood group B individuals 34.8%. In contrast, among females, the trend reversed, with blood group B at 36.95% and blood group O at 31.3%. However, this difference was not statistically significant for either gender. Meningioma was observed more often in females with blood groups O and AB, and this association was statistically significant $P > 0.05$. Other tumor types were also more frequently identified in male patients with blood group O, as well as in female individuals with blood group B. Consequently, meningioma occurred more often in individuals above age of 50, while glioma was greater frequently seen in patients younger than 50. Cavernoma and neuroma were more frequently observed among adulthood individuals 11–40 years and less common at the younger and older age extremes, under 10 and over 60 years. Among individuals aged 11 to 30 years, blood type B exhibited a greater occurrence of meningioma, cavernoma, pituitary adenoma, and other tumors compared to blood type O, In contrast, Glioma and neuroma exhibited the contrary trend, being higher prevalent with blood group O compared to B. Meningioma, glioma including pituitary adenoma existed more commonly seen in people who have blood group O relative to individuals have blood type B, with a greater prevalence in the 51 to 60-year age range. Likewise, Meningioma occurred greater frequently within individuals aged over 60 years old.[1]

According to M. Allouh, A notable correlation was observed between the presence of ABO blood group antigens and the occurrence of glioblastoma, with individuals in blood group A showing a greater likelihood of developing glioblastoma compared to those in group O (9).

Another study found that individuals with blood group AB had a 3.5-fold increased risk of developing glial tumors compared to those with other ABO blood groups. ABO blood type system is vital in tumor development, as it influences the levels of circulating pro-inflammatory and adhesion molecules. Furthermore, the recent identification of von Willebrand factor as a key regulator of blood vessel formation and cell death offers a strong rationale for the involvement of the ABO blood type in tumor development (7, 41).

Citation	Study Characteristics	Variables Measured	Results
Zheng et al., 2023[41]	Retrospective study 158 patients were include	Age, blood group	Blood type AB was linked to a higher risk of mortality in patients who underwent surgical removal of brain metastases.
Patidar et al., 2022[1]	Out of 1,970 patients, 33.55% had glioma, 20.05% had pituitary adenoma, and 2.23% had neuroma.	Age, gender, frequency, ABO blood type	Individuals possessing blood type B exhibited a greater frequency of glioma, cavernoma, meningioma, pituitary adenoma, schwannoma, and similar tumors, with types O, A, and AB following. Neuroma occurred solely in those with blood type O.
Cornelia Englisch et al., 2022[38]	Cohort Study	ABO blood type	Individuals with AB, A, or B blood types showed a greater propensity for cancer-associated venous thromboembolism, with a risk on par with the general population lacking cancer.
Al Shudifat et al., 20218	Observational study 81 children diagnosed with primary brain tumors and 148 healthy controls	Age and gender, higher birth weight	An elevated probability of pediatric primary brain tumors was observed in individuals with blood type. AB, whereas type O was not associated with a higher risk relative to types A and B.
Arsic, 2021[7]	Case–control study 100 individuals include	ABO blood group, age and sex-matched gender	Individuals possessing blood type AB showed a 3.5-fold higher likelihood of developing glioma compared to individuals with other ABO blood types.
Lin et al., 2020[18]	Cohort study	Age, gender	Glioma occurred more frequently in men than in women. For assessing risk, appropriate age classifications divide individuals into 15–47 years as the youth category, and48-63 years as the middle-aged group and 64 years and older as the elderly category. This grouping is useful for evaluating glioblastoma risk in glioma patients.
Hilde E. Groot et al. 2020[43]	Cohort study 406755 unrelated individuals were included	ABO blood group, age, gender	ABO blood types were mainly linked to cardiovascular outcomes. In contrast, individuals Possessing blood types A and B had up to 1.56 times higher chances of thromboembolic events, while showing reduced odds of hypertension compared to those with blood type O.
Fevzi Coskun et al., 2020[39]	Retrospective study 2038 patients	Age, gender, surgery, type chemotherapy or radiotherapy	In elderly patients, incomplete tumor resection, the absence of adjuvant treatment and non-O blood type were identified as negative prognostic factors in the multivariate analysis.
Azanjac Arsić A, et al., 2019[31]	Observational study included 100 glioma cases confirmed by pathology.	Age- and sex-matched, gender, age, place of birth and residence, blood type, Rh factor	AB Blood type connection with an increased likelihood of developing glioma compared to other blood types.

Table 1: Summary of included eligible studies on Relationship of Neurological Tumors with ABO Blood Group

Koul et al., 2018[33]	Retrospective, non-randomized snapshot study	Gender, Living conditions, Life style choices and dietary behavior	The most common blood groups across all cancers were Blood Groups A and B.
Allouh MZ et al., 20179	Cohort study consisted of 115 glioblastoma patients	Age, gender, ABO grouping and Rh classification.	Individuals with blood group A demonstrated an increased tendency for glioblastoma occurrence compared to predictions, whereas those with blood type O showed a diminished probability.
Renu Thambi et al., 2017[32]	Retrospective analysis 510 cases of brain tumors taken	Age category and Male/female classification	Most brain tumors occur in individuals aged 40 to 60, with amale-to-female ratio of 0.9:1. Meningiomas and glial neoplasms were the most commonly observed histopathological types.
B.N. Kumarguru et al., 2017[11]	Analytical type of study	ABO blood type	The preponderance of brain tumors is seen in individuals aged 40 to 60, with a male-to-female ratio of 0.9:1. These tumors mostly impact the dura and cerebral regions, excluding the occipital lobe, with meningiomas and glial neoplasms as the predominant histological forms. WHO grade IV tumors and metastatic lesions were more commonly observed in males than in females.
Xu et al., 2017[34]	Retrospective evaluation	Age, Sex category, marital condition, health coverage status, Cultural background, Histopathological, tumor size, Surgery, radiation therapy, and a combination of surgery and radiation	Results from the multivariable Cox regression analysis showed that patients of Asian or Pacific Islander background experienced better overall survival.
Akca et al., 2014[15]	Case control study, 72 patients with Glioblastoma Multiforme	Age, sex, ABO Blood Group	ABO blood type showed no influence on patients diagnosed with glioblastoma multiforme.
Jain A et al., 2011[35]	Retrospective study 3936 pediatric patients	Age	The most commonly observed the astrocyte-derived tumor was identified as pilocytic astrocytoma. In children, oligodendrogliomas and lymphomas were less common than in adults.
K. Akhtar et al., 2010[14]	Crossectional study 2640 histologically proven cancer patients	age, sex, ABO blood type	All cancers were compare together, then the maximum distribution of blood types existed as follows: B at 40.5%, followed by A at 34.2%, O at 16.0%, and AB at 9.3%.
Masoud Mehrazin, 2006[13]	Retrospective study 907 patients 1980-2002	Different Blood groups	No notable differences were observed between the different categories of brain tumors and the occurrence of the main blood group types.

Cont. Table 1: Summary of included eligible studies on Relationship of Neurological Tumors with ABO Blood Group

DISCUSSION

In India, brain tumor cases range from 5 to 10 per million people, contributing to 2% of all cancer cases (1,32,36). For a long time the researcher has been studied the correlation between blood group markers and brain tumors, discovered within blood groups and many tumors (18,40). Risk factors of the neurological tumors are the genetic changes in the chromosomal region. According to Lin et al, in patients which aged group 21 to 40 years have found mostly glioma tumors and lowest in age >60 years (18). Glioma occurrence was higher in blood group B, then O, A, and AB. According to certain other studies, blood type O exhibited a greater prevalence compared to blood group B (17,19). Conversely, another study revealed that blood type A shows a greater prevalence of glioma (20). A large long-term cohort study also found no correlation between ABO blood group antigens and glial tumors (21).

In these studies, the relation in Blood type and age the Glioma occurred more Within <40 years age group patients having blood group O rather than glioma higher in >40 years patients with B blood group. According to this study glioma was less in female patients compare to male Patients and it appeared approximately same B and male patients with blood group O. In comparison, female patients showed a higher prevalence in blood group B (22).

Approximately 20% of the patient group in our study was found to have pituitary adenoma and meningioma (22). Mayr and colleagues (23) a larger number of pituitary adenomas were found in people with blood type O, while Chang et al (17). observed a significantly reduced incidence was seen in individuals with blood types B and AB. There was no difference in the prevalence of pituitary adenoma between genders across all blood groups. Considering age and blood group distribution, pituitary adenoma was more frequently observed in individuals with blood type B aged between 21 and 40. Earlier studies have shown different correlations between the occurrence of meningioma and ABO blood groups, such as Sowbhagya et al (24). which reported a greater occurrence in individuals with blood type O, Whereas Pearce and Yates (25) discovered a higher prevalence among those with blood type A, Furthermore, Mayr and colleagues (23) reported a greater occurrence in those with blood group B, the prevalence was nearly the same across all blood groups. Meningiomas were notably more prevalent in women with blood groups O and AB (26-29). Neuromas were detected in about 2.23% of individuals in our research. Schwannomas were more frequently observed in individuals with blood type O compared to those with other blood types, exhibiting a statistically significant difference. To the best of our knowledge, no previous studies have established a connection between neuroma tumors and ABO blood types. This frequency occurred greatest within the adulthood aged group 21 to 40 years, compared to the younger 0 to 10 years and older over 60 years age groups. Bondy et al. 2010 (30) conducted studies on syndromes, familial clustering, genetic association, and mutagen sensitivity in adults, suggesting a hereditary predisposition to glioma. While genetic conditions caused by rare inherited mutations are linked to an increased risk of brain tumors.

CONCLUSION

After reviewed the various studies the findings suggested that there was no substantial correlation within brain tumors along with blood group antigen. Blood type O showed significantly connected to neuroma, while blood group AB showed a higher association with glioma tumors. We also found that glioblastoma presents a greater likelihood for individuals with blood type A compared to those with blood type O.

So its need to identify shortcomings in the current system review and conduct more rigorous experiments on brain tumors for future research that address the above shortcomings using this system review on connection among ABO blood groups and brain tumor formation.

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