ORIGINAL ARTICLE

Central Nervous System (CNS) Tumour Registry: A Single Neurosurgical Centre Experience of Four Years

ZAHID HUSSAIN, ABDUL GHAFFAR, SHAHZAD AHMED QASMI
Department of Neurosurgery, Combined Military Hospital, Rawalpindi

ABSTRACT

Objective: *To evaluate the pattern of CNS tumours according to site and age.*

Study Design: *Observational.*

Duration of Study: *1 Jul 2011 to 30 June 2015.*

Patients and Methods: *This is a retrospective audit of CNS tumour registry carried out at our neurosurgical center over the period of four years. A total of 653 cases with age range of 1-80 years, both gender and histopathological proven CNS tumours were included in the study. Data of age, gender, location and histological diagnosis was obtained from the patient's clinical records and entered in study proforma. Data was analyzed by using SPSS (version-17) with descriptive statistics.*

Results: *Overall the Supra-tentorial tumours were 69.52% with commonest site of Parietal in 24.0% and histology of Glioblastoma Multiforme (GBM) in 37.0%. Infra-tentorial tumours were 16.84% with commonest site of Cerebellar in 53.63% and histology of Primitive Neuroectodermal Tumours (PNET) in 26.36%. Sellar tumours were 6.27% and Spinal tumours 7.35% with commonest being Neurofibroma in 39.58% cases. Metastases in CNS were found in 6.38% cases.*

Conclusion: *This analysis depicts that most of the supratentorial tumours of adult age are neuroepithelial in lobar areas especially of GBM type while in children the more common tumours are infratentorial, in cerebellar area and of PNET origin. The audit will help us to stratify our workload management and formulate tumour pathways.*

Keywords: *Central Nervous System, Tumour registry, GBM, PNET.*

Abbreviations: *CNS: Central Nervous System. PNET: Primitive Neuroectodermal Tumours. WHO: World Health Organization. MRI: Magnetic Resonance Imaging. MDT: Multi-Disciplinary Team. CAP: CT Chest Abdomen Pelvis. GA: General Anesthesia. CBTRUS: Central Brain Tumour Registry of the United States.*

INTRODUCTION

Incidence of central nervous tumours have increased over the past few decades.[1] Many models exist in developed world with national tumour registry programs specifically in United States of America (USA), England and other countries are following these.[1,2] However due to loose administration and irregular resource management of health care in Pakistan nothing of that pattern or magnitude can be realized in near future. Some hospitals in Pakistan do provide closed community comprehensive health coverage which can provide a platform for health statistics of their dependent population according to World Health Organization (WHO) 2007 classification of CNS tumours to document the tumour cases.[3]

Overall incidence in USA of all primary malignant and non-malignant CNS tumours is 21.42 cases per 100,000 population, while in adults 10.08 cases per 100,000 and in children 5.3 cases per 100,000 population.[4] In England, around 4,700 males and around 4,700 females were diagnosed with a brain, other CNS or intracranial tumour in 2011 and the most common

types of CNS tumours in England in 2006 – 2010 were astrocytomas (34%) and meningiomas (21%).[5]

Clinical presentations vary according to age, site of tumour and tumour histology. In Pakistan there is no national tumour registry to evaluate the statistics and identify burden of CNS tumours, hence guide clinicians to formulate specific tumour management pathways. Therefore we conducted this audit to evaluate the bulk of central nervous system tumours according to their age, gender, location and histological types in this tertiary referral center for neurosurgery.

MATERIAL AND METHODS

This study was conducted at our Neurosurgery Department from 01 Jul 2011 to 30 June 2015 after obtaining departmental approval from the Hospital Ethical Committee.

Record of outpatients department (OPD) and Indoor clinical records were used to identify cases eligible for inclusion in the registry according to age, gender, site of tumour and histopathology for the purpose of this study.

Convenient non-probability consecutive sampling technique was used, out of total 723 cases admitted and operated for various CNS tumours, only 653 patients record was found eligible for the study. Patients with complete pre-operative workup, surgical treatment and proven CNS tumours cases of both gender and of age ranging from less than 1 year to 80 years were included in the study. 70 cases with incomplete medical record, lost to follow up and histology like arachnoid cysts, epidermoids, dermoids and inconclusive / inconsequential reports were excluded from the study.

Completeness of medical record included detailed history and clinical examination, head Computed Tomography (CT) scan, Magnetic Resonance Imaging (MRI), laboratory studies, bone scan, CT Chest Abdomen Pelvis (CAP) where required and the Multi-Disciplinary Team (MDT) meeting decision.

Patients were operated under General anesthesia (GA) with essential intra-operative monitoring. Surgical strategies ranged from traditional burr-hole biopsy and open biopsies to navigation assisted biopsy/cyto-reduction for aggressive lesions and complete excision of relatively benign tumours according to structure and eloquence of the area involved. Post-operative histology reports reviewed and further follow up/referrals and treatment plan identified.

Data was recorded on structured proforma sheets. The parameters recorded were age, gender, site of lesion and histology. Data was analysed by descriptive statistics in terms of frequencies, percentages and mean ± standard deviation using SPSS (Version 17). Descriptive variables were analysed using a univariate analysis.

RESULTS

Analysis of 653 CNS tumours revealed that bulk of patients were in 4th decade with mean age of 37.71 years (±17.621). Over all incidence rate was 69.8% in males, and 30.2% in females with male to female ratio of 2.31.

Keeping in view the site of CNS tumours, Supratentorial was the most favoured site with 454 cases and Parietal lobe involvement was commonest in this category in 109 cases. Infra-tentorial tumours were recorded in 110 cases with commonest site involved was Cerebellum in 59 cases. Other common sites were Spinal tumours in 48 cases and Sellar tumours in 41 cases (Table 1).

Histologically predominantly seven groups were identified with commonest were Glial cell tumours in 53.74% cases followed by cranial and spinal nerve tumours, meningiomas, embryonal tumours, metastases, pituitary and ependymomas in 9.64%, 8.42%,

Table 1: *Various CNS tumours by Morphology and site of tumours.*

CNS Tumours by Histology and Site: Total 653 cases		
Histological Group	**Number of Cases**	**% of all CNS Tumours**
Glial cell tumours (Astrocytoma, glioma, Oligodendroglioma)	351	53.74%
Ependymomas	26	3.98%
Meningiomas	55	8.42%
Pituitary	41	6.27%

Cranial and spinal nerve tumours	63	9.64%
Embryonal tumours	43	6.58%
Metastases	42	6.38%
Other tumour types	29	4.54%
Unknown or unspecified type	3	0.45%
Site of tumours	**Number of cases**	**% of all CNS tumour cases**
Supra-tentorial	454	69.52%
Infra-tentorial	110	16.84%
Sellar	41	6.27%
Spinal	48	7.35%
commonest supra-tentorial site (Parietal)	109	24%
Commonest infra-tentorial site (Cerebellar)	59	53.63%

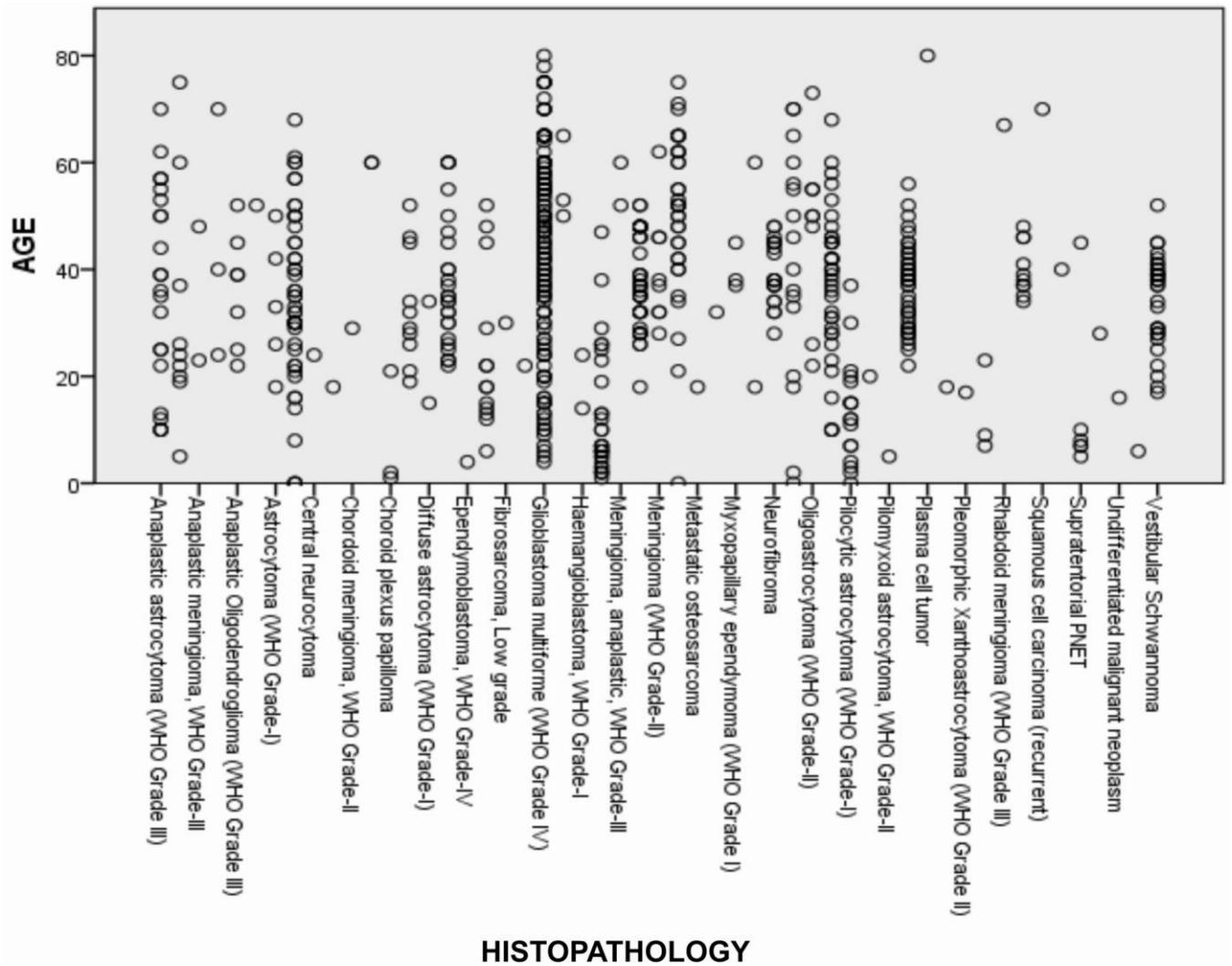

Fig. 1: *Scatter plot showing relationship of age and common tumour histology*.

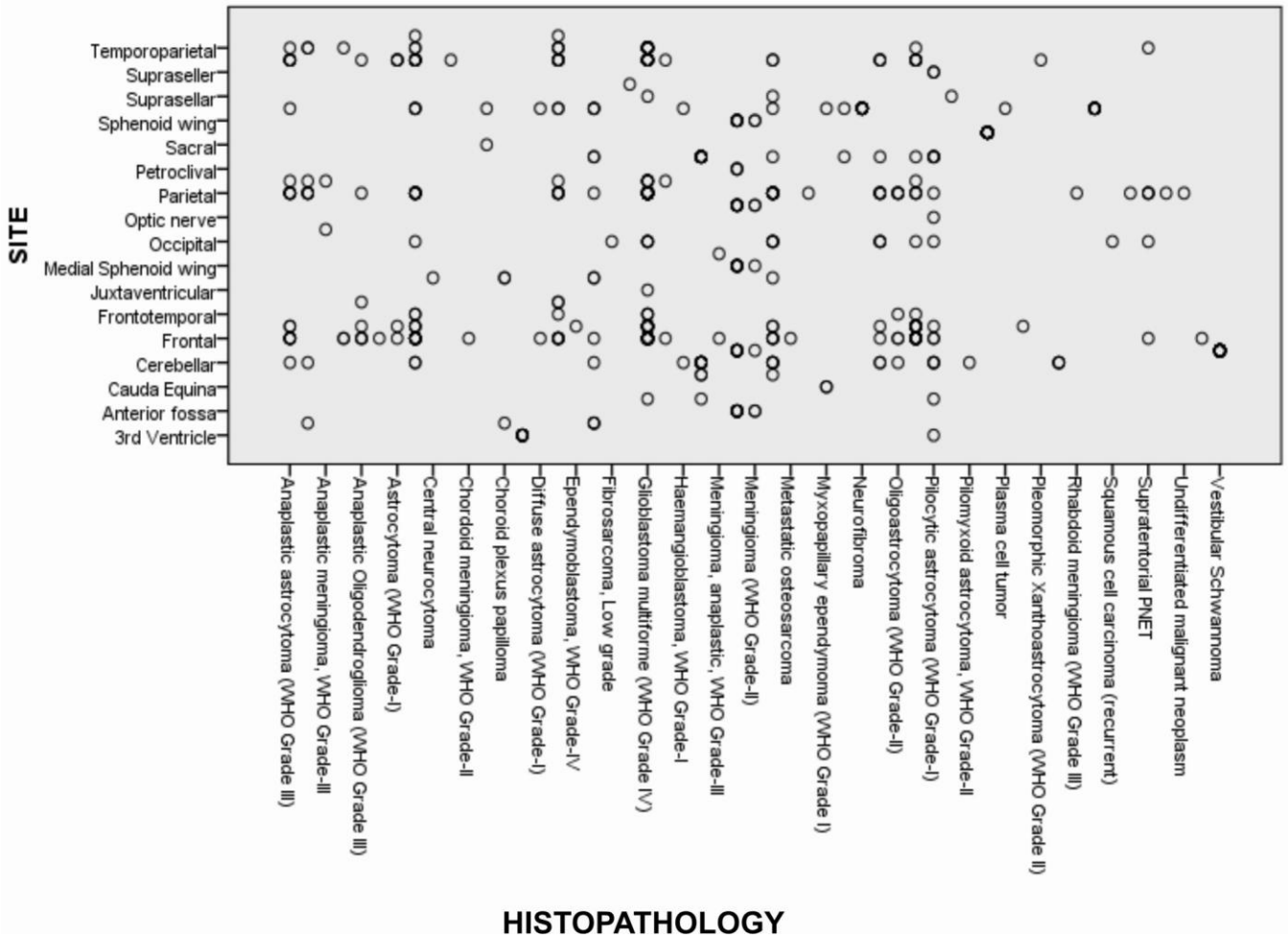

Fig. 2: *Scatter plot showing relationship of common sites and tumour histology*.

6.58%, 6.38%, 6.27% and 3.98% respectively (Table 1).

The most common glial cell tumour was GBM in this series168 cases and was also the most common supratentorial adult tumour (37.0%). The commonest paediatric age tumour was PNET in 29 cases and also predominantly involving infratentorial region (26.36%). Spinal tumours accounted for 7.35% with commonest being neurofibroma in spinal group (39.58%). Metastases were the fifth commonest tumour found in 42 cases of CNS tumours (Fig. 1).

Overall the most common histology was GBM (n = 168), followed by Meningioma (n = 55) and Astrocytoma – WHO Grade II (n = 47) (Fig. 1).

DISCUSSION

Analysis of various CNS tumours was based upon age, gender, site of tumour and histology. The Mean age was in late 4th decade which is slightly younger than other local studies.[6,7] Males were predominant population in our study with male to female ratio of 2.31 which is in concordance with other local studies.[8,9] The incidence has been quoted higher in females in international study but that is the reflection of nationwide study with cent per cent population involvement contrary to our one center study which may not be representative of the whole population across Pakistan.[2,5,10]

The most common location of CNS tumours in our study was supra-tentorial in 69.52% followed by infratentorial (16.84%), spinal (7.35%) and sellar (6.27%) with commonest supra-tentorial site Parietal lobe in 24.0% and commonest infra-tentorial site cerebellum in 53.63% which is congruent with national/ international studies.[11-13]

Histologically GBM was the commonest tumour in 37.0% of supratentorial location and also the most

common CNS tumour in whole series (25.73%). The higher incidence of GBM is our series in comparison with Central Brain Tumour Registry of the United States (CBTRUS) database showed high congruency of findings and other local studies.[2,14-16] Mean age at diagnosis for GBM was 46.48 years (±17.81). This younger age is in contrast to the international literature, where mean age at diagnosis is 64 years.[2,10,17,18]

Meningiomas were found the second most common histology forming 8.42% of CNS tumours registry in our series which is in contrast to international tumour registry studies of CBTRUS and Cancer Research UK but comparable to national studies.[2,5,14,19,20]

Chen L et al quoted 38.0% and 36.5% for the above two main histologies, whereas fact sheet from CBTRUS showed 33.7% and 35.5% respectively which is also reflected in a study by Lee CH et al.[2,19,20] Meningiomas are slow growing benign tumours which are less symptomatic and many patients report when they become floridly symptomatic with fairly large tumours and moreover being a developing country imaging facilities are not available in remote areas may be the main reasons for statistical discrepancy.

Astrocytoma – WHO Grade II was the third most common histology based CNS tumour in our series (7.2%) and oligodendroglial tumours made 6.89% of the registry over four years. Hashmi AA et al also reported rise in incidence of oligodendroglial tumours in Pakistan and the above incidence is also congruent with international studies.[15,21]

Pituitary tumours made 6.27% representation in our series which is congruent with CBTRUS of 8.6% and Malik S et al.[2,22]

Metastases to CNS were found in 6.38% of our series, which is statistically comparable to local studies and study by Chen L et al.[7,19] Detection of brain micro metastases by high resolution stereotactic magnetic resonance imaging is a newer modality to early diagnosis and probably more treatable metastases in the brain.[23] However in our series only the surgically operated cases have been represented excluding the non-operable, non-operated and multifocal metastases.

Children and early teens had PNET as the commonest infra-tentorial (31.81%) CNS tumour and 3.22% of the whole series. In Comparison with the CBTRUS database and Asirvatham JR et al and Pinho RS et al, statistical drifts were seen due to many factors of bias in the study population and not representative of the scale of comparison.[2,24,25]

Nevertheless this study and its results will help us stratify our clinical priorities in establishing central database with unique identification numbers for patients, which can be tracked nationwide through various oncology hospitals/departments and also help us plan the latest infrastructure development to deal with clusters of tumour patients in specific tumour pathways e.g. high grade glioma pathway of 6 weeks.

The limitations of our study include selection bias due to intention to treat patients, single neurosurgical center series, retrospective collection of data and small sample size not representative of the whole country population. Further larger population based, prospective study with oncology treatment arm and outcomes may help in finding refined indices of the CNS tumours registry and national average prognosis.

CONCLUSION

This analysis conformed to worldwide data that most of the supratentorial tumours of adult age were neuroepithelial in lobar areas especially of GBM type while in children the more common tumours were infratentorial, in cerebellar area and of PNET origin. The study highlights the need to prioritize setting up national/ provincial tumour registry, formulation of tumour pathways for patients and resources recruitment for their implementation.

Address for Correspondence:
Lt. Col. Dr. Zahid Hussain
MBBS, FCPS (Surg), FCPS (Neurosurg), Fellowship Neurosurg (RCSEd)
Department of Neurosurgery
Combined Military Hospital, Rawalpindi
Office: 31768, Mob: +92 (0) 302-858-8911
Email: zahidsurgeon@gmail.com

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AUTHORS DATA

Name	Post	Institution	E-mail
Lt. Col. Dr. Zahid Hussain		Department of Neurosurgery, Combined Military Hospital, Rawalpindi	zahidsurgeon@gmail.com
Dr. Abdul Ghaffar			
Dr. Shahzad Ahmed Qasmi			