EPID-15. AGE AND DOSIMETRIC IMPACTS ON RADIOTHERAPY ASSOCIATED GROWTH IMPAIRMENT FOR PATIENTS WITH INTRACRANIAL GERM CELL TUMORS (GCTS)

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PURPOSE: Intracranial germ cell tumors (GCTs) are rare pediatric central nervous system (CNS) tumors. Growth impairment induced by radiation treatments was rarely evaluated. We aimed to study the impacts of radiotherapy on height development and identify the dosimetric constraints. MATERIALS AND METHODS: A total of 148 pediatric patients diagnosed with GCTs were retrospectively analyzed. Sex, age at irradiation, physical doses and biologically effective dose (BED), height, and endocrine status were obtained from patient records. The cumulative change in height was assessed using age-matched normalized height (ANH). Variables were assessed for correlations and statistical significance. RESULTS: Cumulative physical doses and BEDs for the whole brain and pituitary were derived via DVHs and BEDVHs. In contrast to patients >11.5 yr, linear correlations between ANH and cumulative physical doses as well as BEDs to the whole brain and pituitary were identified in patients≤11.5 yr. Dosimetric constrains to the pituitary was 36 Gy for physical dose (AUC=0.70 [95% CI, 0.54-0.86], $P< 0.05$) and 63 Gy_2 BED (AUC=0.69 [95% CI, 0.53-0.86], $P< 0.05$). Intriguingly, no significant differences in ANH were found among different CSI dose groups in patients ≤11.5 yr. (all $P>0.05$). Impaired hormone secretions in terms of GH and TSH were identified following cranial irradiation (both $P< 0.001$), particularly for those with tumors at the suprasellar region (GH: $P< 0.01$, TSH: $P< 0.001$). CONCLUSION: Our study revealed the impacts of age, dosimetrics and tumor locations for growth impairment. This study will contribute to the optimization of radiation treatment planning and facilitate more individualized therapeutic strategies in pediatric patient with GCTs.

EPID-16. DIFFUSE LEPTOMENINGEAL GLIONEURONAL TUMOR IN PEDIATRIC PATIENTS: A QUANTITATIVE EXPLORATION

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BACKGROUND: Diffuse leptomeningeal glioneuronal tumor (DLGNT), also known as oligodendrogliomatosis, is a rare neuro-oncologic condition along the neuraxis that remains poorly understood in children. We sought to describe our institutional experience and quantitively summarize the clinical survival and prognostic features of DLGNT in the pediatric population across the contemporary literature. METHODS: We report four institutional cases of pediatric DLGNT diagnosed between 2000-2020 based on retrospective review of our records, and performed a comprehensive literature search for published cases from 2000 onwards to create an integrated cohort for analysis. Kaplan-Meier estimations, Fisher's exact test, and logistic regression were utilized to interrogate the data. RESULTS: Our overall integrated cohort consisted of 54 pediatric DLGNT patients, with 19 (35%) female and 35 (65%) male patients diagnosed at an average age of 6.4 years (range, 1.3-17 years) by means of surgical biopsy. Chemotherapy was used in 45 cases (83%), and mean follow-up time of 54 months (range, 3-204). Across the entire cohort, overall survival 1 month after diagnosis was 96% (95% CI 86-99%), and by 10 years was 69% (95% CI 49-82%). On multivariate analysis of complete data, chemotherapy treatment (HR=0.23, P=0.04) was statistically predictive of longer overall survival. When including limited data, longer duration of symptoms by presentation (HR=1.03, P=0.03) was statistically predictive of shorter overall survival. CONCLUSIONS: This is the first quantitative study of pediatric DLGNT clinical course. More than 2-out-of-3 pediatric DLGNT patients survive beyond one decade. Chemotherapy is statistically associated with longer survival in DLGNT pediatric patients and should form the core of any treatment regimen in this setting. Early detection by means of judicious imaging and surgical biopsy for tissue diagnosis can lead to earlier treatment and likely superior outcomes.

EPID-17. COMPARATIVE EPIDEMIOLOGY OF PRIMARY BRAIN TUMORS AMONG ADOLESCENTS AND YOUNG ADULTS (AYA)

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INTRODUCTION: We utilized national registry data to evaluate the unique epidemiology of primary adolescent and young adult (AYA) brain tumors according to the WHO2016 classification. METHODS: AYA patients (15≤age≤39) presenting between 2004-2017 with a brain tumor were identified by ICD-O-3 coding from the National Cancer Database (comprising >70% of newly-diagnosed cancers in the U.S.), and compared to pediatric and adult populations. Epidemiology and overall survival (estimated by Kaplan-Meier techniques and multivariable Cox regression) were assessed by WHO2016 tumor type. RESULTS: 108,705 AYA brain tumor patients were identified (56.9% female), compared to 23,928 pediatric (46.8% female) and 748,272 adult (55.6% female) patients. Among the 69.4% of AYA brain tumors with pathological diagnosis, diffuse gliomas (31.4%), sellar tumors (19.2%), and meningiomas (15.3%) predominated in both sexes. Diffuse glioma (31.4%), sellar (19.2%), cranial nerve (7.3%), and mesenchymal non-meningothelial (4.1%) tumors represented a greater proportion of AYA brain tumors than in either pediatric or adult populations. A majority of all intracranial GCTs (59.2%) and neuronal & mixed neuronal-glial tumors (51.6%) presented during AYA. Although the prevalence of diffuse gliomas was similar between AYAs and adults, AYA gliomas were more likely to be grade 2-3 astrocytomas (38.9% vs 14.3%) and oligodendrogliomas (19.3% vs 4.3%) than in adults. GBMs represented 76.0% of adult diffuse gliomas vs. only 25.7% of AYA diffuse gliomas, but with a similar prevalence of MGMT promoter methylation (40.8% vs 38.4%). Notably, 50.7% of AYA PCNSLs were associated with HIV/AIDS, vs only 7.1% in adults (p< 0.001). CONCLUSIONS: The distribution, epidemiology, and survival outcomes of primary brain tumors in the AYA population are distinct from their pediatric and adult counterparts. Notably, AYA infiltrative gliomas were more often of lower grade than adults and AYA PCNSL were far more likely to be associated with HIV/AIDS. Primary brain tumors in AYA patients require specialized management.

EPID-18. USING GERMLINE VARIANTS FOR DIFFERENTIAL DIAGNOSIS OF INDETERMINATE BRAIN LESIONS: EVALUATING THE EFFECT OF TUMOR TYPE AND RACE ON SENSITIVITY AND SPECIFICITY OF GLIOMA POLYGENIC RISK MODELS

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Abnormalities on brain MRI may be identified in ~15% of individuals aged 50-66. It can be difficult to discriminate glioma, CNS lymphoma, Inflammatory Demyelinating Disease (CNSIDD) and solitary metastasis, and misdiagnosis may expose patients to unnecessary anxiety, surgery, or radiotherapy. CNS lymphoma requires only biopsy, solitary metastasis may be resected and radiated or radiated empirically, and high-grade glioma requires maximal safe resection followed by chemoradiation. CNSIDD should only be biopsied when diagnostic uncertainty requires it, and resection and radiotherapy are unnecessary, introducing unwarranted morbidity. Polygenic risk models can identify patients at the highest risk of developing glioma; we hypothesized that these polygenic models could help with differential diagnosis of indeterminate brain lesions. We also hypothesized that race would be an important contributing factor in the models. In the initial discovery and validation European (EUR) cohorts the mean probability of glioma for IDHmut non-codeleted glioma was 0.55 and 0.52, respectively, and in healthy controls was 0.19 and 0.21, respectively. To further evaluate sensitivity, we analyzed additional genotype data from 867 gliomas (764 EUR, 54 AFR, 24 AMR, 15 EAS, 10 SAS) from The Cancer Genome Atlas (TCGA). Across 764 EUR IDHmut non-codeleted glioma, the mean probability 0.53, whereas across 54 AFR and 24 AMR the mean was 0.22 and 0.32, respectively. To evaluate specificity, we analyzed 3200 TCGA patients with primary tumor types that commonly metastasize to the brain (2676 EUR, 365 AFR, 46 AMR, 95 EAS, 18 SAS), and 236 AFR healthy controls. For patients with non-CNS primary tumors, the mean probability ranged from 0.09-0.18 for EUR and 0.04-0.07 for AFR. For AFR healthy controls, the mean was 0.05. Overall, race is a significant factor for polygenic risk models. Further work entails evaluating polygenic risk models in IDHwt glioma, CNS lymphoma and CNSIDD cohorts as well as in additional races.

EPID-19. CONDUCTING A NATIONWIDE BRAIN TUMOR EPIDEMIOLOGY STUDY IN AN LMIC: A MULTI-INSTITUTIONAL EXPERIENCE

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Very little research has been conducted on brain tumor epidemiology in Pakistan and a few studies that do exist provide regional data only. Conducting population based epidemiological studies in low-and-middle income countries (LMICs) like Pakistan can be particularly challenging due to limited resources, poor clinical and research infrastructure, unreliable or

incomplete hospital records and a lack of standardization across the health care system. Population-wide studies and registries play an important role in cancer epidemiology and can help identify the current magnitude of cancer burden and its likely future evolution, allowing for better planning of prevention, diagnosis, management, and rehabilitation. This paper describes our experience in designing and conducting Pakistan Brain Tumor Epidemiology Study (PBTES), a first-ever nationwide study carried out to assess the distribution of brain tumors in Pakistan. In addition to the aforementioned obstacles, we were also faced with the global health crisis caused by the COVID-19 pandemic and had to promptly adjust our study accordingly. Other investigators conducting epidemiological studies in LMICs with similarly challenging and constricting settings could benefit from our experiences.

EPID-20. THE RISING INCIDENCE AND PREVALENCE OF BRAIN TUMOURS: A CANADIAN EPIDEMIOLOGICAL STUDY

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BACKGROUND: Primary malignant brain tumours account for over one third of all brain tumours and are associated with high morbidity and mortality. The purpose of this paper is to estimate the rate and trends of incidence and prevalence for primary malignant CNS tumours in Canada from 1992 to 2017. METHODS: An epidemiological study using publicly available data from Statistics Canada: Canadian Cancer Registry (CCR) from 1992 to 2017 for all of Canada was conducted. Incidence and prevalence per 100,000, age-standardized incidence, and age-standardized prevalence per 100,000 person-years of primary malignant CNS tumours were calculated and stratified by sex and age: pediatric (0-19), adult (20-64), and elderly (>64) populations. RESULTS: During the study period, incidence and prevalence increased by 27.3% and 28.8%, respectively. Males accounted for 56% of all diagnoses and experienced decreased survival compared to females one year after diagnosis (p-value = 0.04). Age-standardized rates of incidence and prevalence were highest in elderly populations. CONCLUSIONS: Overall, the incidence of primary malignant CNS tumours has increased from 1992 to 2017 with males and the elderly disproportionately affected. Increased healthcare resources and awareness are needed to better identify and deliver evidence-based care for these patients.

EPID-21. EPIDEMIOLOGY AND RISK FACTORS OF PRIMARY CENTRAL NERVOUS SYSTEM (CNS) TUMORS IN CHILDREN AND ADULTS IN THE MIAMI CANCER INSTITUTE (MCI) COHORT

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BACKGROUND: Many epidemiological studies assess risk factors and incidence of primary CNS tumors in the United States; few describe the incidence in specific geographic locations. Environmental or ethnic/racial factors may affect the incidence of primary CNS tumors. Miami-Dade County (MDC) is an ethnically-diverse US county, with 69.4% Hispanic, 12.9% White Non-Hispanic, 15.5% Black Non-Hispanic, Asian 1.6%, 0.3% Native, and 0.3% other. We characterized primary CNS tumors at Miami Cancer Institute (MCI) relative to national reports. METHODS: We reviewed electronic medical records for all patients (n=1221) diagnosed with CNS tumors at MCI from 2017 to 2021. Descriptive and statistical analyses assessed environmental and clinical variables. RESULTS: Malignant CNS tumors account for 74% of MCI primary CNS tumors. Diffuse gliomas (41%), meningiomas (26%), and embryonal tumors (5%) were the most common histologies; embryonal tumors most common at younger ages (median: 18 years). The most abundant histological subtypes were glioblastoma (54%), benign meningioma (92%), and medulloblastoma (73%), respectively. Ethnic/racial composition of glioma patients at MCI was 55.9% Hispanic, 24.6% White Non-Hispanic, 6.4% Black Non-Hispanic, 1.8% Other Non-Hispanic, 1.3% Asian, 10% unreported, comparable to MDC. Compared to national averages, the age distribution at MCI was higher among lower grade gliomas (range: 15-96, Median: 61 years), yet lower for malignant gliomas (range: 1-93, median: 47 years). The incidence of malignant CNS tumors did not differ by gender; benign primary CNS tumors were significantly more frequent in females (245/324, 76%; $p< 0.001$). Smoking history did not associate with incidence of primary CNS tumors; 793/1221 (65%) self-reported as non-smoker. CONCLUSION: The ethnic/racial composition and incidence of primary CNS tumors by histology at MCI significantly differs from national CBTRUS database (Ostrom *et al*). This cohort will be further characterized by genetic profiles, race, diet, allergies, family history, substance use, clinical trial enrollment, therapeutic modalities, and overall survival rate.

EPID-22. IMPROVED SHORT-TERM OUTCOMES AND LONG-TERM SURVIVORSHIP IN RELATION TO IMMUNOTHERAPY FOR PATIENTS WITH GLIOBLASTOMA BASED ON ANALYSIS OF THE NATIONAL CANCER DATABASE (NCDB)

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OBJECTIVES: To explore the impact of immunotherapy on short-term outcomes and long-term survival rates, and the predictors of immunotherapy receipt in patients with glioblastoma (GBM) using NCDB. METHODS: A total of 74245 GBM patients were derived from the NCDB from 2004 to 2014. Analyses include short-term outcomes (at least 6-month, 1-year, or 2-year after diagnosis) and long-term survivorship (at least 3-year). The Kaplan-Meier method and accelerated failure time (AFT) models were performed for survival analysis. The multivariable binary logistic regressions were applied to identify predictors of immunotherapy receipt. Random survival forest was conducted to validate the variable importance and decision tree as well. RESULTS: A total of 766 (1.0%) GBM patients received immunotherapy as the first-line treatment. The multivariable binary logistic regressions identified the significant predictors related to immunotherapy receipt, including the recent years of diagnosis (especially 2013 and 2014), age < 65 years, higher income, private insurance, residence-hospital distance >50 miles, care transition, treatment at the facility located in South regions or academic facilities, and adjuvant therapy. After adjusting sociodemographics, facility characteristics, and clinical treatments (surgery and adjuvant therapy), patients received immunotherapy experienced the significantly prolonged OS compared to those who didn't [OS (months): 16.0 vs. 9.8, log-rank test p-value: < 0.001; Time Ratio (TR): 1.26 vs. 1.00 (Ref.), multivariable AFT p-value: < 0.001]. In multivariable logistic regressions, compared to patients without immunotherapy, the likelihoods of 6-month (OR: 3.89, p< 0.001), 1-year (OR: 2.38, p< 0.001), and 2-year (OR: 1.58, p=0.001) survival rates were significantly increased for those received immunotherapy. Regarding the long-term survivorship, immunotherapy was significantly associated with a 68% higher likelihood of 3-year survival rate (p=0.004). CONCLUSIONS: Our findings demonstrated that immunotherapy in GBM patients, albeit small sample size, was significantly associated with improved short-term outcomes and 3-year survivorship after adjusting traditional clinical treatments and other covariates.

EPID-23. THE PAKISTAN BRAIN TUMOR EPIDEMIOLOGY STUDY: PAVING THE WAY FOR A NATIONAL BRAIN TUMOR REGISTRY

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INTRODUCTION: In Pakistan, brain tumor epidemiology has been examined in single-centre studies or as part of general cancer registries, which are limited by catchment area, age group, or are not specific to brain tumors. The Pakistan Society of Neuro-Oncology conducted a nationwide study to assess the distribution of brain tumor distribution and associated risk factors. This unfunded study explores data from across Pakistan and serves as a potential model for LMICs to emulate. METHODS: A cross-sectional study was designed to include patients diagnosed with brain tumors in major neurosurgical centers in Pakistan retrospectively from January-December 2019. Patients, both alive and deceased, with a radiological diagnosis of a brain tumor were included. Data were recorded on a comprehensive online form from 35 centers, encompassing an estimated 85% of all the brain tumor patients seeking initial treatment by a neurosurgeon from the public and private sectors. Data collection was split into three regions: Sindh and Balochistan; Punjab; and Khyber Pakhtunkhwa and Islamabad. Data collection occurred between August 2020 and January 2021. RESULTS: A total of 2750 brain tumor cases were recorded of which 1897 (69%) were diagnosed in the private sector hospitals. MRIs were a more common radiological study compared to CT scans. 2666 surgeries were performed, 174 individuals underwent chemotherapy and 479 underwent radiation therapy; approximately two-thirds of the patients that require adjuvant treatment are not able to receive it. Gliomas were the most common tumor, while pineal tumors were the least common. Findings indicate a low metastasis frequency and few females seeking care. CONCLUSION: The study shows that brain tumors are mostly diagnosed and operated on in the private sector; the public sector should be more engaged. The study also highlights that despite