PATH-27. MUTATION DETECTION USING PLASMA CELL-FREE DNA IN CHILDREN WITH CENTRAL NERVOUS SYSTEM TUMORS

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BACKGROUND: The role of plasma cell-free DNA (cfDNA) as a cancer biomarker has continued to grow as our understanding of early detection has been well described for solid tumors outside the central nervous system (CNS). However, the presence of a blood-brain barrier complicates the application of plasma cfDNA analysis for patients with CNS malignancies. METHODS: cfDNA was extracted from plasma of pediatric patients with CNS tumors utilizing a QIAamp® MiniElute® kit and quantitated with Qubit 2.0 Fluorometer. Extensive genomic testing, including targeted DNA and RNA solid tumor panels, exome and transcriptome sequencing, as well as copy number array, was performed on matched tumor samples as part of the Texas KidsCanSeq study. An Archer® Reveal ctDNA28 NGS kit was then used for assessing the sensitivity of detecting tumor-specific mutations in the plasma of these patients. RESULTS: A median of 10.7 ng cfDNA/ml plasma (Interquartile range: 6.4 – 15.3) was extracted from 78 patients at time of study enrollment. Longitudinal samples from 24 patients exhibited a median yield of 7.7 ng cfDNA/ml plasma (IQR: 5.9 – 9.1). An initial cohort of 6 patients was identified with 7 somatic variants covered by the Archer® Reveal kit. Four of seven mutations identified in matched tumor specimens were detected in patient plasma at variant allele frequencies ranging from 0.2–1%. CONCLUSIONS: While challenging, detection of cfDNA in the plasma of pediatric patients with CNS tumors is possible and is being explored in a larger patient cohort along with pilot studies investigating cerebrospinal fluid as an additional source for tumor-specific cfDNA.

PATH-28. MOLECULAR DIAGNOSIS FOR CENTRAL DIAGNOSIS OF BRAIN TUMORS FROM 2016 TO 2019—A REPORT FROM THE TEXAS KIDS CANSEQ STUDY

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INTRODUCTION: Since 2016, the Japan Children’s Cancer Group (JCCG) has established a nationwide network that prospectively provides pathological review and molecular analysis. METHODS: Patients who were diagnosed with brain tumors between 2016 and 2019 were enrolled. A national central diagnostic system has now been well established. Current issues and future prospective of the system will be discussed.
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Surgery consists in the mainstay of treatment in most gliomas, but in many cases, a resection is not feasible. Liquid biopsy is an ideal tool providing a minimally invasive method through plasma or CSF sampling to another source of DNA (cDNA). Here, we explore the feasibility of detecting DNA in plasma exosomes (exoDNA) extracted from glioma patients and further investigate its use in identifying molecular alterations. Exosomes were isolated from 2ml of plasma from 24 patients (13 LGG, 8 HGG, 3 DIPG) and fully characterized by nanoparticle tracking analysis and transmission electron microscopy. DNA was extracted from 13 samples (exoDNA) so far. Five patients had confirmed point mutations in the primary tumor (3BRAFV600E; 1FGFR1N546K; 1H3.3), additionally, 3 samples were collected from clinically diagnosed DIPG patients to inquire H3K27M. DNA was extracted successfully from all exosome samples; a pre-amplification step was needed and direct sequencing was carried out for BRAFV600E. FGFR1N546K and H3K27M mutations were sought in patients with positive tumors. Wildtype BRAF fragment was identified in 12/13 samples (1 patient failed sequencing). However, none of the five tumor positive patients nor the DIPG patients had mutations detected at the exoDNA level. There is growing evidence that CSF may be the ideal source of cDNA in brain tumor patients, therefore although we could not detect mutations in plasma DNA we are currently analyzing CSF exoDNA and cell-free DNA to evaluate if this proves a successful strategy and whether exoDNA is more representative of the tumor content.

PATH-31. THE IMPACT OF MOLECULAR PROFILING OF PEDIATRIC CNS TUMORS ON TUMOR DIAGNOSIS AND MANAGEMENT - A SINGLE CENTER EXPERIENCE
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BACKGROUND: Next generation sequencing (NGS) plays a role in neuro-oncology research and in clinical diagnosis and management. Here, we describe how NGS for pediatric CNS tumors impacted clinical diagnosis and therapeutic decision making. METHODS: NGS was performed on tumors. Using the UCSF 500 Gene Panel (targeted sequencing platform covering about 500 cancer associated genes). Patients were selected for NGS based on tumor pathology need to identify therapeutic targets. We collected data on patient demographics, tumor histology/pathway alterations/therapeutic targets/therapy and used descriptive statistics for data analysis. RESULTS: Between January 2016 and July 2019, about one-third of patients with CNS tumors seen at our institution (N=29) were interrogated. NGS revealed pathway alterations in 20/29 patients. Treatment recommendations/modalities based on pathway alterations impacted the therapy of 18 patients. Patient groups: Medulloblastoma (N=6), alterations in WNT, SHH, and TP53 pathways (Vismodegib recommended for SHH pathway alteration but not used). High-grade glioma (N=4), alterations (with treatment changes) included: NF1 (Trametinib, Everolimus); MSH2/MLH1 (Nivolumab); CDKN2A/CDKN2B/CDKN2C (Abemaciclib); EGRF (Oxartemibin, Atatibin); H3K27M (Panobinostat/ONC201); BRAFV600 (Dabrafenib, Trametinib); ATRT (N=1) SMARC-B; Low Grade Glioma (N=10), BRAFV600(Vemurafenib); RAF/AA4194 fusion (Trametinib); PIK3CA; DIPG (N=5), H3K27M/BOR/PC3/APCR/PBK3C (LY2303414, Everolimus)/PDGFR (Dasitumib); Ependymoma (N=3), PAF/PBR/REL Fusion. Seven patients were treated with targeted therapy + conventional therapy. In 8 patients targeted therapy remains an option but not yet five tumor positive patients nor the DIPG patients had mutations detected at the exoDNA level. There is growing evidence that CSF may be the ideal source of cDNA in brain tumor patients, therefore although we could not detect mutations in plasma DNA we are currently analyzing CSF exoDNA and cell-free DNA to evaluate if this proves a successful strategy and whether exoDNA is more representative of the tumor content.

NEUROPSYCHOLOGY/QUALITY OF LIFE
QOL-01. LONGITUDINAL COMPARISON OF NEUROCOGNITIVE TRAJECTORIES IN PEDIATRIC MEDULLOBLASTOMA PATIENTS TREATED WITH PROTON VERSUS X-RAY THERAPY
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PURPOSE: By reducing dose to normal brain tissue, proton radiotherapy (PRT) may lessen neurocognitive risk traditionally associated with photon radiotherapy (XRT). We examined change in neurocognitive scores over time in pediatric medulloblastoma (MB) patients treated with XRT versus PRT. METHODS: Neurocognitive scores from 79 patients (37 PRT; 42 XRT) were examined. Patients were treated between 2007–2018 on the same treatment protocols that differed only by craniospinal modality (PRT versus XRT). Change in scores over time since diagnosis were compared between groups. RESULTS: Groups were similar on most demographic/clinical variables: sex (67.1% male), age at diagnosis (mean 8.6 years), CSI dose (median 23.4 Gy), length of follow-up (mean 4.3 years), and parental education (mean 14.3 years). Boost dose (p<0.001) and margin (p<0.001) differed between groups. Adjusting for covariates, the PRT group exhibited superior outcomes in global IQ, perceptual reasoning, and working memory versus the XRT group (all p<0.05). The XRT group exhibited significant decline in global IQ, working memory, and processing speed (all p<0.05). The PRT group exhibited stable scores in all domains except processing speed (p=0.003). Posterior fossa syndrome imparted risk independent of modality. CONCLUSION: This is the first study comparing neurocognitive trajectories between pediatric patients treated for medulloblastoma with PRT versus XRT on comparable, contemporary protocols. PRT was associated with more favorable neurocognitive outcomes in most domains compared to XRT, although processing speed emerged as vulnerable in both groups. This is the strongest evidence to date of an intellectual sparing advantage with PRT in the treatment of pediatric medulloblastoma.

QOL-02. PERCEPTIONS OF LATE EFFECTS CARE NEEDS AMONG SURVIVORS OF PEDIATRIC BRAIN TUMORS
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OBJECTIVES: Pediatric brain tumor survivors are at risk of long-term consequences of therapy. Comprehensive late effects care may mitigate these sequelae. We sought to describe the care experience and quality of life (QOL) of pediatric brain tumor survivors at the McMaster Children’s Hospital joint adult/pediatric Neuro-Oncology clinic. METHODS: Cross-sectional survey data were collected. Care needs were assessed with the Cancer Care Experience Questionnaire (CCEQ), Cancer worry Scale (CWS), and Self-Management Skills Scale (SMSS). Quality of life was measured utilizing the PedsQL Brain Tumor Module. Data were analyzed descriptively. RESULTS: Thirty-two childhood brain tumor survivors and/or their parents participated. Their malignancies included embryonal tumors (medulloblastoma/ATRT) (62%), ependymoma (22%), and germ cell tumours (16%). Among 77%, therapy included chemotherapy, surgery and radiation. Most respondents reported high quality cancer care, although some could not recall discussions of late effects risks and health promotion. Mean cancer worry scores were lower (7.1 [2.8]) among survivors. Survivors reported limited self-management skills (58.5 [±18.2]), with support required in clinic visits, arranging medical appointments, filling prescriptions and tasks of daily living. Overall median QOL scores were in the ‘good’ range (parent 72.3 [17.7], survivor 69.2 [16.0]), CONCLUSION: In comparison to other childhood cancer survivor cohorts, this group of long-term brain tumour survivors appear to have similar QOL, fewer cancer worries, and increased need for care and self-management. Given this, along with the positive care experience reported, this clinic model of care appears to meet the needs of this population.

QOL-04. INFLUENCE OF FAMILY, SCHOOL, AND HOSPITAL SYSTEMS IN SUPPORTING SURVIVORS OF PEDIATRIC BRAIN TUMORS WITH NEUROCOGNITIVE LATE EFFECTS
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OBJECTIVE: Pediatric brain tumor survivors (PBTS) are at risk for developing neurocognitive late effects that may interfere with academic and adaptive functioning. To mitigate the potential impact, some PBTS may implement strategies independently, while others may rely on system-level support from family, school, or hospital systems. Given the limited knowledge on survivor and family perspectives of these supports, we conducted a mixed-methods study involving PBTS and their caregivers to examine the