

cording to the surgical concept involved, the patients were divided into three subgroups-complete en bloc concept, partial en bloc concept and piecemeal concept. The matching-comparison(en bloc group consisting of the first two subgroups and piecemeal group) was conducted to investigate the effect of the en bloc concept on the short-term outcomes. Then the patient data after January 2018, when the en bloc concept was routinely integrated into brain tumor surgery in our medical center, were reviewed and analyzed to find out the predictors associated with the application of en bloc concept. RESULTS: In the en bloc group, the perioperative outcomes, including hospital stay( $p=0.001$ ), PICU stay( $p=0.003$ ), total blood loss( $p=0.015$ ), transfusion rate( $p=0.005$ ) and complication rate( $p=0.039$ ), were all significantly improved. The multinomial logistic regression analysis showed that tumor volume, bottom vessel, and imaging features, like encasing nerve or pass-by vessel, finger-like attachment, ratio of "limited line" and ratio of "clear line" remained independent predictors for the application of en bloc concept in our medical center. CONCLUSION: The application of en bloc concept based on the imaging features can improve the short-term outcomes.

#### SURG-02. THE SITE OF ORIGIN OF MEDULLOBLASTOMA: DOES THE NEUROSURGICAL PERSPECTIVE SUPPORT THE CURRENT CONCEPT FROM MOLECULAR DATA?

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BACKGROUND: Medulloblastoma (MB) are the most common malignant brain tumor in childhood. Developmental gene expression data supported by neuroradiological studies suggest that Wingless (WNT)-MB originate from the lower rhombic lip (LRL), Sonic-Hedgehog (SHH)-MB from the cerebellar hemispheres, and Group 3 and Group 4 MB from the cerebellar vermis. However, there is still insufficient evidence from a neurosurgical perspective supporting this proposed concept. METHODS: Clinical and molecular data from patients aged under 18 years at time of diagnosis who were operated on a histologically confirmed MB at the Department of Neurosurgery of the Medical University of Vienna between 1990 and 2020 were retrospectively analyzed. The location of the tumor origin was defined based on operative reports, surgical videos and preoperative imaging data by an experienced neurosurgeon blinded to the subgroup information. RESULTS: Sufficient data were available in 53 patients. In 28.6% (2 / 7) WNT-MB, 66.7% (6 / 9) SHH-MB and 70.3% (26 / 37) Group 3 and Group 4 MB, the intraoperatively defined site of origin corresponded well with the cellular origin suspected from the molecular subgroup. Within the WNT-subgroup, 57.1% (4 / 7) originated from the vermis, 28.6% (2 / 7) from the LRL and 14.3% (1 / 7) from the cerebellar hemisphere. The origin of SHH-MB was predominantly located in cerebellar hemispheres (66.7% (6 / 9)), while 33.3% (3 / 9) originated from the vermis. Of Group 3 and Group 4 MB, 70.3% (26 / 37) had their origin in the vermis and 29.7% (11 / 37) in the LRL. CONCLUSION: Our results indicate that there is a considerable level of inconsistency between the intraoperatively observed site of origin and the expected cellular origin based on the molecular subgroup, especially in WNT-MB. This discrepancy needs to be discussed when it comes to surgical decision-making accounting for risk stratification.

#### SURG-03. DURABILITY OF AN EARLY MANAGEMENT STRATEGY FACILITATING ENDOSCOPIC REMOVAL OF RECURRENT CHOROID PLEXUS CARCINOMA

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BACKGROUND: Choroid plexus carcinoma (CPC) is a rare, primarily intraventricular neoplasm with a dismal prognosis. Extent of surgical removal is correlated with improved outcomes but is frequently limited due to tumor vascularity and size. Information related to surgical management and molecular drivers of tumor recurrence is currently limited. Here we characterize a case of multiply recurrent CPC treated solely with sequential endoscopic tumor removals over a 10-year period and highlight its genomic properties. METHODS: We performed a retrospective review of a 16-year-old female treated for CPC with local and distal recurrences undergoing repeat excision with minimally invasive neuro-endoscopy. We describe technical nuances associated with neuro-endoscopic intervention, mean hospital stay, complications, and perioperative MRI. Whole exome sequencing (WES), targeted sequencing, and methylation profiling results over time are reviewed. RESULTS: Five years after standard treatment, the patient was

evaluated for a distant intraventricular recurrence. A total endoscopic resection was performed given the local, non-disseminated recurrence pattern. WES results included NF1, PER1, and GLI3 mutations as well as FGFR3 gain, and was negative for TP53 alterations. Repeat sequencing on a recurrence 4 years later showed persistent NF1 and FGFR3 alterations. Methylation profiling was consistent with "plexus tumor, subclass pediatric B". Overall, short-term surveillance neuroimaging detected four isolated recurrences, all treated with complete endoscopic resections at 5 years, 6.5 years, 9 years, and 10 years after initial CPC diagnosis. Mean hospital stay for all recurrences was 1 day with no complications from treatment. CONCLUSION: We describe a patient with 4 isolated recurrences of CPC over a decade, each treated with complete endoscopic removal, and identify an unusual set of molecular alterations that persisted over time. These outcomes support a strategy encompassing frequent neuroimaging surveillance to facilitate a minimally invasive endoscopic surgical approach at early detection and relatively low tumor mutagenicity.

#### SURG-04. ROBOTIC ALIGNMENT SYSTEM CIRQ (BRAINLAB) FOR NAVIGATED BRAIN TUMOR BIOPSIES IN CHILDREN

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BACKGROUND: With the incorporation of the robotic alignment system Cirq (Brainlab, Munich, Germany) into our neurosurgical armamentarium, we deemed it important to study application accuracy of this new device. As a baseline, we retrospectively reviewed our historical data on brain tumor biopsies using the non-robotic alignment instrument Varioguide (Brainlab, Munich, Germany). Because of relatively high target registration errors in this historical series, we sought to improve our registration with the introduction of Cirq. AIMS: 1. Share our experience with the new robotic alignment system Cirq for navigated brain tumor biopsies. 2. Compare patient-to-image registration methods. 3. Evaluate the accuracy of Cirq robotic system as compared to the non-robotic instrument Varioguide. METHODS: All patients (0-19 years old) who underwent a brain tumor biopsy at the Princess Máxima Center, Utrecht, were included. Over the period 2018-2020, data were collected retrospectively (cohort "Varioguide" in which patient-to-image registration was based on preoperative MRI with adhesive scalp fiducials). From 2021 onwards, data were collected prospectively (cohort "Cirq" in which patient-to-image registration was done using 1. A preoperative MRI with adhesive scalp fiducials and 2. An intraoperative CT head scan with bone screw fiducials). For both cohorts, Euclidian distances were calculated between the intended target and the obtained target using postoperative MRI scans. PRELIMINARY RESULTS: Nineteen patients were biopsied with Varioguide and nine patients with Cirq. The Cirq robotic system was convenient and safe in use with no intraoperative complications. Patient-to-image registration was more accurate when based on bone screw fiducials as compared to scalp fiducials. The Cirq robotic system, combined with bone fiducial registration, resulted in a high target accuracy with a maximum target error of 2 millimeters. CONCLUSION: The Cirq robotic alignment system, combined with bone screw fiducial registration, provides a safe and highly accurate method for brain tumor biopsies in children.

#### SURG-05. SURVIVAL AND FUNCTIONAL OUTCOMES IN PEDIATRIC THALAMIC AND THALAMOPEDUNCULAR LOW GRADE GLIOMAS

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BACKGROUND: Childhood thalamopeduncular gliomas arise at the interface of thalamus and cerebral peduncle. The optimal treatment is total resection but not at the cost of neurological function. We present long-term clinical and oncological outcomes of maximal safe resection. METHODS: