

single-center study in CNS tumor patients managed with CSI from 1986–2018. Clinical details, and echocardiography including myocardial-strain-analysis were collected at T1=first echocardiogram after CSI, and T2=most recent echocardiogram. Data are mean±standard deviation. Echocardiograms were available in 44 patients (36%female, 14±8.0years) at T1 and 39 patients (38%female, 21.0±11.3years) at T2. Standard echocardiography was normal for all subjects. At T1, global longitudinal peak systolic strain (GLS) was -16.3%±3.7% in CSI vs. -21.6%±3.5% in controls (p<0.0001); global radial peak systolic strain (GRS) was 21.5%±10.1% in CSI vs. 26.5%±7.4% in controls, and global circumferential peak systolic strain (GCS) was -19.5%±6.0% in CSI vs. -21.4%±3.4% in controls (p<0.05, both comparisons). At T2, GLS was -15.8%±5.2% in CSI vs. -21.9±3.5% in controls (p<0.0001); GRS was 22.6%±10.4% in CSI vs. 27.1±8.2% in controls (p<0.05); GCS was -20.5%±6.9% in CSI vs. -21.8±3.5% in controls (p=0.10). For 17 patients with myocardial-strain-analysis available for both time points: difference in GLS was 0.06±7.2% (p>0.95); GRS was 5.5±9.5% (p<0.05); GCS was -3.4±4.9% (p<0.05). Subclinical dysfunction is present at first echocardiogram after CSI. Myocardial impairment may recover with time, however further analysis is needed to identify risk factors and trends. These results argue for inclusion of baseline cardiovascular assessment and longitudinal follow-up in CNS tumor patients post CSI.

RONC-32. LOCAL CONTROL FOLLOWING PROTON THERAPY FOR PEDIATRIC CHORDOMA

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BACKGROUND: Due to the location and high dose required for disease control, pediatric chordomas are theoretically well-suited for treatment with proton therapy, but their low incidence limits the clinical outcome data available in the literature. **METHODS AND MATERIALS:** Between 2008 and 2019, 29 patients with a median age of 14.8 years (range, 3.8–21.8) received proton therapy for non-metastatic chordoma at a single institution. Twenty-four tumors arose in the clivus/cervical spine region and 5 in the lumbosacral spine. Twenty-six tumors demonstrated well-differentiated histology and 3 were dedifferentiated or not otherwise specified (NOS). Approximately half of the tumors underwent specialized testing: 14 were brachyury-positive and 10 retained INI-1. Seventeen patients had gross disease at the time of radiation. The median radiation dose was 73.8 GyRBE. **RESULTS:** With a median follow-up of 4.3 years (range, 1.0–10.7), the 5-year estimates of local control, progression-free survival, and overall survival rates were 85%, 82%, and 86%, respectively. Excluding 3 patients with dedifferentiated/NOS chordoma, the 5-year local control, progression-free survival, and overall survival rates were 92%, 92%, and 91%, respectively. Serious toxicities included 3 patients with hardware failure or related infection requiring revision surgery, 2 patients with hormone deficiency, and 2 patients with Eustachian tube dysfunction causing chronic otitis media. **CONCLUSION:** In pediatric patients with chordoma, proton therapy is associated with a low risk of serious toxicity and high efficacy, particularly in well-differentiated tumors. Complete resection may be unnecessary for local control and destabilizing operations requiring instrumentation may result in additional complications following therapy.

NEUROSURGERY

SURG-02. INITIAL MANAGEMENT OF HYDROCEPHALUS IN THE PEDIATRIC AND YOUNG-ADULT PATIENTS WITH BRAIN TUMORS; THE EFFICACY OF LONG-TERM INDWELLING EXTERNAL VENTRICULAR DRAINAGE

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BACKGROUND: Pediatric and Young-Adult (AYA) brain tumors often present with hydrocephalus. As temporary cerebrospinal fluid (CSF) diversion procedure, we perform long-term indwelling external ventricular drainage (EVD) in the case of the management of CSF diversion more than two weeks presumably. The aim of this study is to investigate the initial management for hydrocephalus in pediatric/AYA patients with brain tumor, especially about long-term EVD. **MATERIALS AND METHODS:** The patients less than 30 years of age diagnosed with brain tumor between 2005 and 2019 were retrospectively analyzed. Procedures of long-term EVD were similar to that of ventriculoperitoneal shunt (VPS) operation. Using flow-control VPS system, peritoneal catheter passed out of the body at the

anterior chest, and distal end of the catheter was connected to standard EVD system. **RESULTS:** In total of 345 patients with brain tumor, 109 had hydrocephalus at presentation. Among them, 25 patients (23%) underwent long-term EVD. The main reasons for selecting long-term EVD were to avoid intraperitoneal dissemination (n=13), and to maintain longer period of CSF diversion for the treatment of tumor (n=12). The median of long-term EVD was 38 days (range: 12 – 222 days). Although one case suffered from drainage tube occlusion at 59 days, there were no other complications such as infection or accidental evulsion. Eventually, 3 cases required permanent VPS for persistent hydrocephalus. **CONCLUSION:** Long-term EVD is safe and effective option for CSF diversion. This procedure should be taken into consideration if patients have a risk of dissemination and may elude permanent VPS.

SURG-03. IMMERSIVE VIRTUAL REALITY APPLICATIONS IN NEUROSURGICAL ONCOLOGY

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Tridimensional (3D) rendering of volumetric neuroimaging is increasingly being used to assist surgical management of brain tumors. New technologies allowing immersive virtual reality (VR) visualization of obtained models offer the opportunity to appreciate neuroanatomical details and spatial relationship between the tumor and normal neuroanatomical structures to a level never seen before. We present our preliminary experience with the Surgical Theatre, a commercially available 3D VR system, in 60 consecutive neurosurgical oncology cases. 3D models were developed from volumetric CT scans and MR standard and advanced sequences. The system allows the loading of 6 different layers at the same time, with the possibility to modulate opacity and threshold in real time. Use of the 3D VR was used during preoperative planning allowing a better definition of surgical strategy. A tailored craniotomy and brain dissection can be simulated in advanced and precisely performed in the OR, connecting the system to intraoperative neuronavigation. Smaller blood vessels are generally not included in the 3D rendering, however, real-time intraoperative threshold modulation of the 3D model assisted in their identification improving surgical confidence and safety during the procedure. VR was also used offline, both before and after surgery, in the setting of case discussion within the neurosurgical team and during MDT discussion. Finally, 3D VR was used during informed consent, improving communication with families and young patients. 3D VR allows to tailor surgical strategies to the single patient, contributing to procedural safety and efficacy and to the global improvement of neurosurgical oncology care.

SURG-04. THE APPLICATION OF EN BLOC RESECTION IN THE OPERATION OF PEDIATRIC POSTERIOR FOSSA TUMOR

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OBJECTIVE: To explore the efficacy and safety of en bloc resection therapy on posterior fossa tumor in children. **METHODS:** A retrospective analysis was conducted on the clinical data of 94 patients with posterior fossa tumor admitted to Department of Pediatric Neurosurgery, Xinhua Hospital Affiliated to Shanghai Jiaotong University School Of Medicine from January 2018 to December 2019. Among them, 35 cases were treated with traditional resection (control group) and 59 cases with en bloc resection (observation group). We counted the amount of blood loss and the time during tumor resection. We compare the symptoms and signs between the two groups and determine a extent of tumor resection based on microscopic observation and preoperative and postoperative imaging comparison. **RESULT:** The total tumor resection rate of the observation group (88.1%, 52 / 59) was significantly higher than that of the control group (62.85%, 22 / 35, P < 0.05). The average bleeding volume of 90.8ml in the observation group was significantly smaller than that of the control group (113.3ml, P < 0.05), and the average operation time of 38.6min in the observation group was shorter than that of the control group (57.4min, P < 0.05) only for tumor resection procedure. **CONCLUSION:** En bloc resection technique can effectively accelerate the resection time, reduce intraoperative bleeding and improve the total resection rate of tumors in children's posterior cranial fossa.

SURG-05. AN AWAKE SURGERY FOR A CHILD SUFFERING FROM EPILEPSY DUE TO DYSEMBRYPLASTIC NEUROEPITHELIAL TUMOR LOCATED IN THE LEFT PARIETAL LOBE

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BACKGROUND: An awake surgery is a useful measure to remove tumors located close to eloquent areas of the brain to reduce surgical complications and maximize the resection. However, it has some disadvantages compared to surgeries under general anesthesia. Generally speaking, applying it to a child under 15 years-old (y/o) is hesitating because of anxiety, poor tolerance, failure to cooperate in tasks and so forth. Here, we present a case of a 13y/o girl who underwent an awake surgery due to dysembryoplastic neuroepithelial tumor (DNT) located in the left parietal lobe. **CASE PRESENTATION:** She consulted our hospital for epileptic seizures. MRI showed a multilobular mass lesion in the left parietal lobe. The tumor was located in or close to eloquent areas. The epilepsy was refractory even with multiple antiepileptic drugs (AEDs). A Wada examination revealed that her speech area is on the left hemisphere. The operations were performed in two stages. Prior to the operations, we had several thought-out simulations in the operating room and ICU with her, her parents, and our staff including nurses and lab technicians. The first operation was to perform tumor biopsy and place intracranial electrodes. The histological diagnosis was DNT. Video electroencephalogram showed that the epileptogenic lesion was around the tumor. The second operation resulted in total tumor resection and reduction of paroxysmal epileptic spikes without major complications. She is seizure free for more than three years with two AEDs. **CONCLUSION:** Careful preparations may enable an awake surgery even for a child under 15y/o.

SURG-06. AWAKE CRANIOTOMY FOR BRAIN TUMOR IN PEDIATRIC PATIENTS

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BACKGROUND: The challenge of surgery in neurooncology is to achieve the maximum extent of resection while preserving eloquent functions. Intraoperative cortical mapping during resection of a brain tumor allows direct stimulation in eloquent areas with a reduction in postoperative deficits. This procedure has been performed in adults and children down to the age of 11 years. There are only two cases reported on the literature of an 8-year-old and 9-year-old child submitted to an awake craniotomy for brain tumor resection. Pediatric patients are prone to more risks than adults because they become easily agitated after pain sensation. Extensive preparation for the procedure is essential for pediatric patients in order to avoid a lack of cooperation. **CASE PRESENTATION:** Two patients, with 9-year-old presented with seizures due to a tumor in the left temporoparietal region. In order to identify language and motor-controlling areas during resection, we proposed an awake craniotomy. Because of their ages, they were prepared by a multidisciplinary team. The children's cooperation during the mapping procedure and tumor resection were exceptional. Postoperative cranial MRI confirmed partial resection of the lesion, whose remnant was located in the left motor area. No seizures occurred during the postoperative period, and both were discharged without a neurological disability on the fifth day after the surgery. Histology revealed a dysembryoplastic neuroepithelial tumor (WHO grade I). **CONCLUSION:** Brain mapping during resection of a tumor in an awake pediatric patient is feasible and can be safely performed even in patients under 11-year-old.

SURG-07. CEREBELLAR PEDUNCLE TUMORS IN PEDIATRIC NEUROSURGERY: FEW CITATIONS FOR BEING RARE OR FOR LACK OF AWARENESS

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We present a case-series of 6 pediatric patients, with a follow-up for a minimum of 1 year, with a diagnostic, therapeutic and prognostic description. This type of disease was first mentioned by Professor Tomita in 1986, in a case-series with 4 patients, with few citations in literature, no other case series cited at the literatures, and in our oncology center of excellence it is an entity that draws attention for diverging from intrinsic tumors of the cerebellum, fourth ventricle and trunk. In this way, we created an algorithm approaching these patients and would like to present this associated to honoring the esteemed professor in neurosurgery.

SURG-08. SUPRASELLAR DERMOID CYST IN A PEDIATRIC PATIENT

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BACKGROUND: Intracranial dermoid cysts (DC) are rare congenital non-neoplastic lesions that account for 0.04 – 0.6% of all intracranial tu-

mors. They are formed by a fibrous capsule composed of epidermal and dermal derivatives (hair follicles, sebaceous and sweat glands), enclosing a viscous fluid. Intracranial DC often arise in the midline and are more common in infratentorial locations. **CASE REPORT:** A 14-year-old male patient presented with headache, partial motor seizures and behavioral changes. Neurological examination and endocrine workup revealed no abnormalities. Brain magnetic resonance imaging showed a lesion that was 4.4cm x 2.2cm x 4.4cm in size, located at suprasellar region, and extended superiorly to the left lateral ventricle and anterolaterally to the left orbitofrontal lobe, associated with hyperintense fat droplets in the right lateral ventricle. We performed a left transventricular microsurgical approach. The tumor capsule was coagulated and opened and a subtotal resection with piecemeal removal of the the lesion was obtained: it had gelatinous consistency, composed of droplets of fat and hair and keratinized scamous epithelium content. A total removal of the DC capsule was not possible due to its firm adherence to optic chiasm and to hypothalamus. Histological examination revealed dermoid cyst. **CONCLUSION:** Surgery is the only effective treatment, and its goal should be the radical resection of the lesion to avoid recurrence. Whenever radical resection is not possible, because of the adhesions of the cyst capsule to surrounding tissues, a subtotal resection with piecemeal removal may be a satisfactory option in such cases to avoid high morbidity.

SURG-09. REACTIVATION OF HERPES SIMPLEX VIRUS AFTER NEUROLOGIC SURGERY

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BACKGROUND: Herpes simplex virus encephalitis (HSVE) is a rare complication after neurosurgery, and its clinical picture mimics features of other most frequent infectious complications of bacterial origin. Probable triggering factors are manipulation and surgical stress, since most cases occur due to reactivation rather than primary infection. The main symptoms include fever and altered consciousness. DNA identification of HSV by PCR has accuracy. Even with adequate treatment, HSVE is associated with a mortality of 30%, and potential neurologic sequelae such as cognitive and motor. **CASE REPORT:** An 18-year-old male patient presented with loss of vision due to cystic craniopharyngioma. We inserted an Omay catheter and drained the cyst. On the third day, he presented with fever, seizures, and decreased consciousness. Magnetic resonance imaging (MRI) showed high signal intensity on T2-weighted and FLAIR images in the left frontal and temporal lobe, cingulate gyrus, and corpus callosum, with mass effect. He was submitted to decompressive craniectomy and empirical antibiotic therapy. CSF and blood cultures were negative. Due to inexpressive clinical improvement after 48 hours, CSF was collected for polymerase chain reaction (PCR), and we performed a brain biopsy and started intravenous acyclovir. Histology and PCR confirmed HSVE type 1 and 2. He received antiviral for two weeks and was discharged after CSF PCR negative. **CONCLUSION:** Clinical suspicion, CSF PCR, and imaging are of paramount importance for early diagnosis of HSVE, which should be considered in the differential diagnosis of recent postoperative neurologic surgery in cases of unexplained postoperative fever with altered consciousness.

SURG-10. SPECTROSCOPIC MEASUREMENT OF 5-ALA-INDUCED INTRACELLULAR PROTOPORPHYRIN IX IN PEDIATRIC BRAIN TUMORS

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OBJECTIVE: 5-ALA guided resection of glioma in adults enables better delineation between tumor and normal brain, allowing improved resection and improved patients' outcome. Recently, several reports were published regarding 5-ALA for resection of pediatric brain tumors. The aim of the study was to determine the intracellular fluorescence of PPIX in pediatric brain tumors by hyperspectral imaging and to compare it with visually observed intraoperative fluorescence. **METHODS:** 5-ALA was administered orally four hours prior to surgery. During tumor resection the surgeon assessed the fluorescence signal to be strong, weak or absent. Subsequently, fluorescence intensity of samples was measured via spectroscopy. In addition, clinical data, imaging and laboratory data were analyzed. **RESULTS:** Eleven children (1–16 years) were operated. Tumor entities included: three medulloblastomas, two pilocytic astrocytomas (PA), two anaplastic ependymomas and one diffuse astrocytoma, anaplastic astrocytoma, pilomyxoid astrocytoma and anaplastic pleomorphic xanthoastrocytoma. Strong fluorescence was visible in all anaplastic tumors and one PA; one PA demonstrated weak fluorescence. Visible fluorescence was strongly associated with intracellular fluorescence intensity and PPIX concen-