

tration ( $P < 0.05$ ). Within all tumors with visible fluorescence the intracellular PPIX concentration was greater than 4  $\mu\text{g/ml}$ . Except for moderate and transient elevation of liver enzymes, no 5-ALA related adverse events were reported. **CONCLUSION:** We demonstrate a strong association between intraoperative observations and spectrometric measurements of PPIX fluorescence in tumor tissue. As in former studies, fluorescence signal was more commonly observed in malignant glial tumors. Further prospective controlled trials should be conducted to investigate the feasibility of 5-ALA guided resection of pediatric brain tumors.

#### **SURG-12. PAEDIATRIC BRAIN TUMOUR SURGERY: HOW CAN WE REPORT OUR SURGICAL OUTCOMES AND OPERATIVE MORBIDITY?**

Mitchell Foster<sup>1</sup>, Dawn Hennigan<sup>1</sup>, Rebecca Greystone<sup>1</sup>, Kirsten van Baarsen<sup>1</sup>, Geraint Sunderland<sup>1</sup>, Christopher Millward<sup>1</sup>, Harishchandra Srinivasan<sup>1</sup>, Deborah Ferguson<sup>1</sup>, Teddy Totimeh<sup>2</sup>, Barry Pizer<sup>1</sup>, and Conor Mallucci<sup>1</sup>; <sup>1</sup>Alder Hey Children's Hospital, Liverpool, Merseyside, United Kingdom, <sup>2</sup>Korle Bu Teaching Hospital, Korle Bu, Ghana

**OBJECTIVE:** Our objective was to quantify resection outcomes and operative morbidity in paediatric brain tumour surgery using existing scales, assessing their applicability. **METHODS:** We investigated morbidity using the Clavien-Dindo (CD) scale and the Drake classification. All paediatric patients receiving a biopsy or craniotomy for an intracranial tumour in a single tertiary paediatric neurosurgery centre between January 2008 and December 2018 were studied. Complications up to day 30 post op were graded. **RESULTS:** There were 459 operations: 92 biopsies and 367 craniotomies comprising 166 infratentorial and 292 supratentorial tumours. Median age was 9 years (56% male). The surgical goal was achieved or exceeded in 94% of cases. Thirty-day mortality was 1.31% with all deaths related to disease and none to surgical complications. The overall CD score was 1 in 10.9% of cases, 2 in 18.9%, 3A in 1.7%, 3B in 11.8%, and 4 in 1.1%. There was no operative morbidity in 54% of cases. Using the Drake classification, meningitis was seen in 3.92% of cases, seizures in 3.92%, neurological deficit (that persisted at 30 days) in 8.5%, CSF leak in 5.01%, wound infection in 1.96%, haemorrhage 1.75%, shunt infection in 1.53%, shunt block in 0.65%, medical complications in 2.4%, and others in 3.05%. **CONCLUSIONS:** This is the largest series presenting morbidity from paediatric brain tumour surgery, and the first to validate the CD scale. Our morbidity on the Drake scale was comparable with other series. There is a need to develop improved tools to quantify morbidity in this high-risk specialty.

#### **SURG-14. ENDOSCOPIC SURGERY FOR PEDIATRIC INTRAVENTRICULAR TUMOR WITHOUT HYDROCEPHALUS: INDICATION, SURGICAL TECHNIQUE, AVOIDANCE OF COMPLICATION, AND ITS PROSPECT**

Shunsaku Takayanagi, Hirokazu Takami, Shota Tanaka, Masahiro Shin, and Nobuhito Saito; The University of Tokyo Hospital, Tokyo, Japan

**INTRODUCTION:** Neuroendoscopic surgery is useful for intraventricular tumors accompanied by ventriculomegaly. However, it is often challenging for cases with small ventricles. Our institution is actively performing surgeries for pediatric intraventricular tumors without frank ventriculomegaly. **METHODS:** Seven cases of intraventricular tumors without ventriculomegaly (5 cases of subependymal giant cell astrocytoma (SEGA) and 2 cases of germ cell tumors (GCTs)) were analyzed. The age ranged between 3 and 14 years (median 5 years). The sizes of SEGA were between 10-27mm, and all the tumors showed an enlargement around the foramen of Monro, which was the indication for surgery. Biopsy and third ventriculostomy were performed for GCTs. For resection, after making a small craniotomy of 2 x 3 cm, ellipse-cone-like sheath with a diameter of 12mm or 17mm was inserted through it to the lateral ventricle, which enabled a wide surgical view. Under a rigid endoscope of 4mm diameter, 2 types of surgical instruments were employed, making the microsurgical procedure like under a microscope, with a wider view, possible. For the cases of tumor resection, septostomy and placement of a drain in the ventricle were performed at the end of surgery. **RESULTS:** The lesions were safely approached in all the cases. For resection, endoscopic microsurgery was possible, and tumor was totally removed in all the cases. No postoperative complication was observed in any of them. **CONCLUSIONS:** Our experience shows that tumor resection can be safely achieved with the aid of endoscope even for cases without ventriculomegaly.

#### **SURG-15. THE SURGERY OF THALAMIC LESIONS IN PEDIATRIC BRAIN TUMORS**

Yuzaburo Shimizu, Osamu Akiyama, and Akihiko Kondo; Juntendo University, Tokyo, Japan

**BACKGROUND:** Pediatric brain tumors are occurred in the center of central nervous system. Since mid-line glioma has defined in the new clas-

sification, thalamus has attracted attention as a site that requires surgical intervention. However, the surgery for thalamus is a challenging procedure for neurosurgeons. In this study, we studied our surgical cases of patients suffering from pediatric brain tumors in thalamus and/or thalamic regions to evaluate the safety of surgeries and the consideration of appropriate surgical approaches. **METHODS:** We reviewed neuroradiological images, medical record, and, surgical videos for the assessment of surgical fields in patients under the age of 15 who had surgical treatments at our institution. **RESULTS:** We had six cases that could be analyzed. The lesions in the posterior parts of the thalamus had been operated by the occipital transtentorial approach. The lesions in the superior parts of thalamus were treated with transcortical transventricle approach. It was possible to achieve sufficient removal of tumors and have good surgical view. The monitoring of motor function and visual function was used in all cases. After removal, we could have a nice view of the important structures around thalamus. **CONCLUSIONS:** The surgeries for thalamus and thalamic regions were safety with enough considerations for neurological examinations and radiological imaging. The intra operative monitoring for motor and visual function should be used.

#### **SURG-16. SURGICAL TECHNIQUES TO AVOID COMPLICATIONS DURING REPEAT RESECTIONS FOR PEDIATRIC BRAIN TUMORS**

Ichijo Shibahara; Kitasato University, Sagami-hara, Kanagawa, Japan

Complications due to repeat resection for recurrent pediatric brain tumors remain unclear. The present study focused on surgical techniques to avoid surgical morbidities during repeat resections for pediatric brain tumors. This study included 57 consecutive repeat resections for 28 pediatric patients under the age of 15 with recurrent brain tumors. Resections were performed 2-14 times for each patient by the senior author (TK). Reviewed factors were wound-related complications, bleeding/ischemic complications, and Eastern Cooperative Oncology Group performance status (PS) before and after surgery. No patients presented any complications to decrease PS, postoperatively. No wound-related complications were worthy of special mention. Surgical techniques to prevent wound-related complications are as follows: 1) shaving the hair around the previous skin incision just before the surgery; 2) washing and disinfecting around the skin incision using chlorhexidine soap and an alcohol swab, followed by Povidone-Iodine solution; 3) after craniotomy, removing all granulation tissues, residual titanium plates, and screws; 4) brushing all surgical fields and a bone flap before opening the dura mater using Povidone-Iodine solution followed by normal saline; 5) maintaining a bone flap in normal saline with antibiotics; 6) changing all the surgical instrument and gloves; 8) closing the dura mater completely to prevent CSF leakage, and 8) using postoperative antibiotics for six days. Meticulous dissecting postsurgical adhesion of brain and dura mater, arteries and nerves; usage of neuronavigation system and neuromonitoring to understand the anatomy radiologically and functionally; applying papaverine hydrochloride for spastic arteries, are important to avoid complications during the intracranial procedure.

#### **SURG-17. CLINICAL CHARACTERISTICS AND OUTCOMES OF EPILEPSY-RELATED BRAIN TUMOR IN CHILDREN**

Kenichi Usami<sup>1</sup>, Keita Terashima<sup>2</sup>, Yuichi Abe<sup>3</sup>, Chikako Kiyotani<sup>2</sup>, and Hideki Ogiwara<sup>4</sup>; <sup>1</sup>Division of Neurosurgery, National Center for Child Health and Development, Tokyo, Japan, <sup>2</sup>Division of Neuro-Oncology, National Center for Child Health and Development, Tokyo, Japan, <sup>3</sup>Division of Neurology, National Center for Child Health and Development, Tokyo, Japan, <sup>4</sup>Division of Neurosurgery National Center for Child Health and Development, Tokyo, Japan

**OBJECTIVE:** Epilepsy is one of the earliest symptoms in pediatric brain tumor. Gross total resection (GTR) of the tumor does not necessarily achieve seizure free, therefore it is controversial whether surrounding epileptic foci should be resected at the initial surgery. The aims of this study are to report clinical characteristics and outcome of pediatric epilepsy-related brain tumor (ERBT) and to discuss treatment strategy. **METHODS:** Subjects were children less than 18 years old who underwent surgery for ERBT. Patients in whom epilepsy had been controlled before surgery were excluded. Data were collected from medical record and retrospectively reviewed. **RESULTS:** Twenty-one children (8 boys and 13 girls) were analyzed in this study. The mean age at surgery was 6.8 years. Tumor was astrocytic tumor in 10, ganglioglioma in 4 and dysembryoplastic neuroepithelial tumor in 3. Intracranial subdural electrodes were placed prior to tumor resection in 5 cases. GTR was achieved in 14 (67%). Seizure free was achieved in 15 (71.4%). GTR was significantly associated with seizure free ( $p = 0.002$ ). **CONCLUSION:** In most of ERBT, seizure free can be achieved by lesionectomy alone. However, the resection of surrounding epileptic foci is required in some cases. Detailed examinations to detect the epileptic foci should be performed in ERBT, particularly in case of drug-resistant intractable epilepsy.