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INTRODUCTION: There exist controversies on recurrence and aggressiveness after use of first-line bevacizumab (BEV) which has been approved in Japan and proven to be beneficial. Therefore, we analyzed the clinical impact of BEV approval by investigating the overall clinical course and glioblastoma (GBM) relapse pattern.

METHODS: We included 100 patients with IDH-wildtype GBM between September 2006 and February 2018 from our institution. They were subdivided into pre-BEV (n=51) and post-BEV (n=49) groups. Overall, progression-free, deterioration-free, and post-progression survivals (OS, PFS, DFS, and PPS, respectively) were compared. We analyzed the relapse pattern of 72 patients, whose radiographic progressions were confirmed.

RESULTS: Significant improvements in DFS (median DFS in the pre-BEV and post-BEV eras: 8.5 and 13.8 months, P=0.0046), and PFS (7.5 and 9.9 months, P=0.0153) after BEV approval were observed. These survival prolongations were strongly correlated (r: 0.91, P<0.0001). Non-enhancing tumor emerged as a novel recurrence pattern in the post-BEV era (five of 33; 15.2%). Changes in relapse pattern did not significantly impact OS, PFS, and DFS. No significant difference in PPS between pre-BEV and post-BEV eras was observed (6.7 and 5.5 months, P=0.2319). The rate of early (within 6 months) focal recurrence was significantly lower (P=0.0155) in the post-BEV era (four of 33; 12.1%) than in the pre-BEV era (18 of 39; 46.2%). A significant decrease in early focal recurrence after BEV approval was observed exclusively in patients with unresectable tumors (P=0.0110). Treatment era was the only parameter significantly correlated with decreased early focal recurrence rate (P=0.0021, univariate analysis; P=0.0144, multivariate analysis).

CONCLUSIONS: We found that, first-line BEV in Japan for unresectable tumors has a positive impact on the prevention of early progression and clinical deterioration of GBM without accelerating the clinical course after recurrence.

ACT-03

CLINICAL OUTCOME AND RADIOLOGICAL FINDINGS OF PATIENTS WITH RECURRENT GLIOBLASTOMAS TREATED BY BEVACIZUMAB

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OBJECT: Seven years have passed since the approval of bevacizumab (BEV) in Japan. We retrospectively reviewed the clinical outcome and radiological findings of patients with recurrent glioblastomas (GB) treated by BEV. METHOD: We reviewed 116 patients, including 27 cases of newly diagnosed GB and 89 cases of recurrent GB, treated by BEV during the study period between 2013 June and 2019 September. Cumulatively, 116 patients received 1672 cycles of BEV. Among those, we focused on 74 patients with newly diagnosed GB treated by BEV at recurrence to examine clinical characteristics, outcome, and radiological findings of T2-circumscribed or double-positive proposed by Nowosieski et al. or Bahr et al., respectively. RESULT: The study cohort comprised median age of 66.8 years (range 10 to 81), median KPS of 60% (range, 20 to 100), median cycles of administration 11(1 to 59), median period of treatment 172 days (0 to 1413), median post-BEV survivals 266 days, and overall survival 693 days. Patients without progressive disease at 6 months post-BEV MRI (n = 23) presented favorable post-BEV survival of 713 days than those with progressive disease (n = 8) (p=0.0003). The radiological findings varied by patients, tumor lesions, and sequential imaging; thus, it was difficult to correlate with survival. Our data implied that the T2-circumscribed lesion was accompanied by no enhancement at T1 but hyperperfused at arterial spin labeling imaging, indicating that blood-brain barriers were intact and vascularization is activated. CONCLUSION: Although our cohort included patients with relatively high age, some had prolonged post-BEV survival. T2-circumscribed or double-positive was not useful to predict the survival; however, MRI at 6 months post-BEV can be an indicator for two years of post-BEV survival.

ACT-05

PRESENT AND FUTURE OF PRECISION-BASED MEDICINE USING CANCER GENOME PANELS

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BACKGROUND: Two cancer genome panels were approved for use in Japan in 2019, and their application in brain tumors are awaited. We have used CANCERPLEXR and FoundationOne CDx (F1) panels for the realization of precision-based medicine in brain tumors. Patients and METHODS: From August 2017 to present, we have applied cancer genome panels in 11 times to tumors in 9 patients. We assessed patient data including age, sex, pathology, reason for using the panel and actionability. RESULTS: The range of age of 4 to 69 years (mean 45.2 years), and 5 men and 4 women were studied. Pathological diagnosis was epithelioid glioblastoma (GBM), giant cell GBM, anaplastic ependymoma, anaplastic meningioma, anaplastic large cell type lymphoma, meningeal melanomatosis, enterogeneous carcinoma, choroid plexus carcinoma and pineoblastoma. CANCERPLEXR was performed 7 times and F1 panel 4 times and the reasons included confirmation specific gene mutations such as BRAF V600E and TP53, young (pediatric) age and patient request. In one patient, by analyzing primary and recurrent tissue, we were able to assess genetic hits involved in malignant transformation. Actionable targets were found in 4 (44%) of cases, and action was taken in only 1 epithelioid GBM patient with BRAF V600E mutation, albeit with dramatic response (Kanamaru et al., Acta Neuropathol Commun, 2019). All tumors were microsatellite stable. CONCLUSIONS: We were able to understand tumor biology in rare brain tumors using 2 genome panels. We need to increase the percentage of patients actually treated. I will also like to touch briefly on how use genome panels for translational research on brain tumors.

ACT-07

CLINICAL TRIALS OF 11C-METHIONINE PET FOR BRAIN TUMORS

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BACKGROUND: Although 11C-Methionine (MET) PET has widely used, 11C-MET tracer has not been approved in Japan. We conducted multicenter prospective clinical trials using MET for drug approval in diagnosis of brain tumors[Methods] Two trials using 11C-MET PET were performed in Hokkaido University, Osaka University and Fukushima Medical University; 1) Diagnostic accuracy in differentiating tumor recurrence from radiation injury after radiotherapy in brain tumors, 2) The diagnostic efficacy in newly-diagnosed gliomas. 1) The patients with suspected brain tumor recurrence underwent MET and 18F-Fluorodeoxyglucose (FDG) PET. When the target lesion showed MET and/or FDG uptake, the patients underwent target resection for pathological confirmation. Positive prediction values of each tracer uptake were assessed as primary outcome measure, and the sensitivities and specificities of each PET exams were also assessed. 2) The patients with suspected gliomas underwent MET PET. Tissue samplings were performed from MET uptake lesions without contrast-enhancement on MRI in each patient, and evaluated the existence of tumor cells. Diagnostic additional values of MET PET on contrast-enhanced MRI was also investigated. Safety of MET PET was also assessed in each trial.[Result] 1) 57 cases were investigated. 38 cases underwent surgery and 32 cases (84%) were confirmed tumor recurrence histopathologically. MET and FDG uptake in 32 recurrence cases were 100% and 50%, respectively. Sensitivities and specificities of tumor recurrence were 84% and 89% in MET, and 100% and 56% in FDG. 2) 53 glioma cases were enrolled. Viable tumor cells were proven in 98% in MET uptake lesion without contrast-enhancement. In 42 out of 53 cases (78%), MET PET depicted tumor area beyond the contrast-enhancement area on MRI. No severe adverse events were observed in both trials. [Conclusions] MET PET were effective in diagnosis of brain tumors, and safety of MET was demonstrated.

ACT-17

PROTOCOL DESIGN OF A MATRIX-TYPE OF NOVEL CLINICAL TRIAL FOR LOWER-GRADE GLIOMAS

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INTRODUCTION: Differentiation between glioma grade 2 and 3 was performed based on histological findings. The current grade is an important prognostic factor due to its widespread use, economic efficiency, and data accumulation, but analog elements remain and the genetic marker is unknown. The concept of Lower-grade glioma including G2/3 is spreading. On the other hand, WHO grade is the criteria of clinical trials, and evidence is established for G2 with low risk and high risk, G3 alone or with G4. In Japan, JCOG 1303 and 1016 have been implemented for high-risk G2 and G3, respectively and will be finished next year. Therefore, we examined the feasibility and design of novel clinical trial for patients with grade 2/3 glioma.

METHOD: With reference to clinical trials of high evidence level and public database registration, we researched trials, arms, and designs for each of 3 genotypes, oligodendroglioma (OD), astrocytoma IDH mutant and IDH wild (A-IDHm, A-IDHw). RESULTS: The standard arm common to all genotypes is follow-up (EORTC22845) for G2 low-risk, and chemoradiotherapy (CRT) for G3. Standard arm for G2 high risk, depending on a genotype, is follow-up (EORTC22845), radiation alone (A-IDHm and IDHw, A-IDHw: RTOG9802 subanalysis), or PCV chemoradiotherapy (OD and A-IDHm: 9802). Furthermore, the standard arm and the test arm were replaced by the matrix-like method on each genotype. Results in the G2/3-targeted trial, there was no standard arm all in the three genotypes. In addition, there were a design of master protocols for many genotype and a design that has arms of randomization and observation. CONCLUSION: Applying the master protocol, the possibility of novel G2/3 target trial in which the arms existing in MATRIX form was suggested. With the improvement of the genetic analysis infrastructure, prospective observational research and a well-designed intervention research plan for each genotype are required

PEDIATRIC CLINICAL TRIALS/THERAPEUTIC STUDIES (PEDT)

PEDT-02

CLINICAL USAGE OF NCC ONCOPANEL/FOUNDATIONONE CDX FOR PEDIATRIC/AYA PATIENTS WITH RECURRENT MALIGNANT BRAIN TUMORS

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BACKGROUNDS: Analyses of somatic mutations in malignant brain tumors have been used to make effective treatment strategies. NCC Oncopanel and FoundationOne CDx are custom targeted next-generation sequencing (NGS) panels. The cost for this analysis is 560,000 yen covered by National Health Insurance in Japan since June 2019. These methods can be applied for the solid cancers with no established therapies and relapsed after the standard therapies. Following these inclusion criteria, most malignant brain tumors, especially recurrent malignant brain tumors in pediatric/AYA generations, can be included. OBJECT: To report the results of our initial experiences. METHODS: In the last one year, we utilized these NGS panels for five patients with recurrent malignant brain tumors in this generations: 2 epithelioid glioblastomas; 1 anaplastic meningioma; 1 diffuse astrocytoma (gliomatosis cerebri); 1 atypical choroid plexus papilloma. RESULTS: Final recommended treatments are as follows: BRAF/MEK inhibitors, bevacizumab, or anti-PD-1 antibody for one epithelioid glioblastoma; MEK inhibitor for another epithelioid glioblastoma previously treated by BRAF inhibitor and bevacizumab; ERK1/2 inhibitors for anaplastic meningioma. The diffuse astrocytoma had IDHR132H mutation. There was no clinical trial using IDH inhibitor for recurrent diffuse astrocytoma; thus, the final recommendation for this case was rechallenge of temozolomide. To date, only one NGS for a choroid plexus papilloma has been reported (Arch Pathol Lab Med, 2017). Our case had multiple actionable gene alterations, including TERT mutation and amplification of various genes. Unfortunately, there was no druggable gene alteration among them. CONCLUSIONS: Insurance-covered cancer gene panel tests could represent effective treatment options for some malignant brain tumors in pediatric/AYA generations. If the relapse is local and can be treated by repeat resections, we think the surgery is the first-line choice. But, in another situation, information from NGS panels should be obtained positively. Efforts to increase the utility of off-label use of drugs are encouraged.

PEDT-03

A CLINICAL TRIAL OF DENDRITIC CELL-BASED IMMUNOTHERAPY FOR REFRACTORY BRAIN TUMORS IN CHILDREN

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BACKGROUND/OBJECTIVES: Relapse or refractory brain tumor in childhood continue to have a dismal prognosis in spite of developing multidisciplinary treatment. Cancer immunotherapy is newly expected as next promising treatment for highly aggressive pediatric cancer. This trial was designed to evaluate the safety and clinical responses to an immunotherapy with fusions of dendritic cells (DCs) and tumor cells in patients with malignant brain tumors. DESIGN/METHODS: Patients with histopathologically confirmed high-grade or recurrent brain tumor were eligible for our immunotherapy. Autologous cultured tumor cells obtained from surgical specimens were fused with autologous DCs using polyethylene glycol. The fusion cells (FC) were inoculated intradermally in the cervical region and repeated 3–10 times in each 28–84 days cycle. Toxicity, progression-free survival (PFS), and overall survival (OS) of this trial were evaluated. RESULTS: Six patients were enrolled, three with high grade glioma and three with ependymoma. Median age at first course of immunotherapy was 10 years (range 8–25 years) and median time of follow-up from first course of immunotherapy was 13.5 months (range 3–33 months). All patients with immunotherapy were well tolerated and no adverse event without local erythema in injected site. Median progression free survival and overall survival were 18 months and 18.5 months, respectively. CONCLUSIONS: FC immunotherapy with autologous DCs and tumor cells for brain tumor in children and young adults were extremely well tolerated and encouraging. Further phase II study of FC immunotherapy is planned to improve prognosis and overcome treatment related neurological sequelae for highly malignant tumors.

SURGICAL/INTRAOPERATIVE THERAPY/ MONITORING (STMO)

STMO-01

CEREBRAL EDEMA AND PERIOPERATIVE EPILEPSY DUE TO PLACEMENT OF BCNU WAFER FOR MALIGNANT GLIOMA

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INTRODUCTION: Cerebral edema is the most frequent adverse event of BCNU wafer, which is used as local chemotherapy of malignant glioma. However, predictive factor of this event is unknown. Moreover, there is no consensus about cerebral edema and perioperative seizure, which is often observed in glioma. Here, we report risk factor of cerebral edema with BCNU placement and relationship with perioperative seizure in malignant glioma cases.

MATERIAL AND METHOD: Thirty-one case of adult malignant glioma who underwent BCNU placement in our institute between March 2013 to March 2019 were investigated. The patients were dichotomized to two groups; patient with postoperative transient cerebral edema (CE+ group) and patient without postoperative transient cerebral edema (CE- group).

RESULT: Postoperative cerebral edema associated with placement of BCNU was observed in 9 out of 31 patients (29%). Tumor malignancy was significant parameter for postoperative cerebral edema (p=0.003). Other factors such as, age, gender, laterality, tumor location, primary or recurrent, number of BCNU wafers, duration of recurrence were not significant for postoperative cerebral edema. Seizure was seen in 14 patients (45%), and cerebral edema was not significant parameter for seizure. Tumor malignancy was significant parameters for postoperative cerebral edema. Tumor malignancy was significant parameters for seizure (p=0.0004). Although postoperative seizure was observed in 4 patients (44%) with CE+ group, neither maximum volume (mean 61.1 ml) nor change ratio (mean 354%) of FLAIR-high-intensity region were not related with postoperative seizure.

CONCLUSIONS: Tumor malignancy was important factor for patients who underwent placement of BCNU wafer with postoperative cerebral edema and seizure. On the other hand, there were no relationship between postoperative cerebral edema and perioperative seizure in patients treated with BCNU wafer.

STMO-02

EFFICACY OF PREOPERATIVE EMBOLIZATION FOR HEMANGIOBLASTOMA

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INTRODUCTION: Preoperative transarterial embolization (TAE) for hemangioblastoma carries a risk of cerebral infarction and hemorrhagic complications, and its safety and efficacy are controversial.

METHOD: Twenty-two cases of hemangioblastoma (cerebellar: 18 cases, medulla oblongata: 3 cases, spinal cord: 1 case) treated via direct surgery in our hospital from 2007 to 2020 were enrolled.

RESULTS: Preoperative TAE was performed in 6 cases of cerebellar hemangioblastoma (1 bilateral case) and 1 case of spinal hemangioblastoma. The cerebellar hemangioblastoma feeders were only superior cerebellar artery (SCA) in 3 cases, SCA/anterior inferior cerebellar artery (AICA)/posterior inferior cerebellar artery (PICA) in 2 cases, AICA/PICA in 1 case, and single drainer in 5 cases. Tumors were ≥30 mm in all cases (25 mm on 1 side in bilateral cases), and solid or nodular lesions were located on the upper surface of the cerebellum. Cerebellar edema was severe in five cases with