malignancy or abnormal enhancement on MRI (p<0.0001). In fact, CSF flow cytometry was negative in all patients who did not have a previous hematological malignancy or abnormal enhancement on MRI (n = 247). **Conclusions:** CSF flow cytometry has very limited role in the screening for primary CNS lymphoma, unless a strictly endorsed testing algorithm is applied. It is, however, an invaluable tool in assessing CNS involvement in patients with previous diagnosis of hematolymphoid malignancy.

P.047

IDH mutations are associated with pro-inflammatory microglia and macrophages in heterogeneously infiltrated glioblastomas

CC Poon (Calgary) R Yang (Calgary) T Sheikh (Calgary) K Liu (Calgary) S Sarkar (Calgary) VW Yong (Calgary) JJ Kelly (Calgary)*

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Background: CNS innate immune cells, microglia and macrophages (MMs), are the largest component of the inflammatory infiltrate in glioblastoma (GBM). They initially participate in tumor surveillance, but are co-opted by GBM to further angiogenesis and invasion. There are no effective immunotherapies against GBM in part because GBM-associated MMs are not well understood. We hypothesized that the extent and inflammatory phenotype of MM infiltration into GBM is variable between patients. This variability could have important implications on immunotherapy selection and treatment outcomes. **Methods:** Using automated quantitation of fluorescently labeled human GBMs, flow cytometry/live cell sorting, collection of conditioned GBM-associated MM media, and corroboration with TCGA and previously published scRNA-seq data, we have uncovered there is surprisingly marked variation in the amount of MM infiltration between tumors. **Results:** MM infiltration can range from almost non-existent, to comprising ~70% of GBM cells. By detecting cell surface markers and secreted cytokines, we determined that a mixture of pro- and anti-inflammatory MMs are found in each tumor. The overall inflammatory phenotype did not depend on the amount of infiltration. Interestingly, IDH-mutant GBM-associated MMs are more pro-inflammatory and less heterogeneous than IDH-wildtype GBMs. **Conclusions:** Taken together, the highly variable immunologic status of GBMs suggests the success of immunotherapies hinges on selecting appropriately vulnerable tumors.

P.048

Correlation of preoperative serum lactate, MR spectroscopy and frozen tissue lactate levels as a biomarker for giomas – a prospective clinical study

OH Khan (Warrenville) JK Nolt (Warrenville) JP Cousins (Columbia) S Agnihotri (Pittsburgh) S Vachhrajani (San Francisco) L Venkatraghavan (Toronto) G Zadeh (Toronto)*

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Background: Lactate, a by-product of glycolysis, has been well established as a marker of poor tissue perfusion. Elevated lactate production is observed in tumor glycolysis known as the Warburg effect. We have previously shown that serum lactate correlated with brain tumor grade. In this prospective study we aimed to determine if the preoperative serum lactate correlated with preoperative MR spectroscopy and in lactate levels in the fresh frozen tissue samples. **Methods:** Twenty-one glioma patients (13 male, 8 female) ages 34 – 86 underwent craniotomy at a single institution by lead author. Tumor pathology revealed a Glioblastoma (n=16), grade II (oligodendroglioma n=1) and Grade III Glioma (anaplastic astrocytoma n=4). Preoperative spectroscopy was performed on 18 patients. A fellowship trained neuro-radiologist (JPC) was blinded to the serum and tissue lactate levels and graded the spectroscopy lactate levels as low or elevated. **Results:** There was direct correlation of spectroscopy tissue lactate levels with serum lactate levels. Pre-operative serum lactate (range 6.6- 29.9 mg/dl) was directly correlated with the fresh frozen tissue lactate levels (range 0.1 – 0.39 ug/mg; Pearson r=0.6 p = 0.0021). **Conclusions:** This study supports that serum lactate correlates with spectroscopy and tissue lactate levels.

P.049

Repeat surgery in recurrent glioblastoma: a systematic review and meta-analysis

JZ Wang (Toronto) F Nassiri (Toronto) JH Badhiwala (Toronto) G Zadeh (Toronto)*

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Background: Recurrent glioblastoma portends a poor prognosis and the role of repeat surgery in improving survival remains uncertain. Our systematic review and meta-analysis aims to address whether re-resection provides a meaningful survival benefit and to what degree. **Methods:** Articles were collected from Pubmed, CINAHL, EMBASE, Medline and Cochrane from January 1990 to 2018. Studies in the temozolomide era with both single surgery and re-resection cohorts were included. Primary outcomes were odds ratio for survival at 6, 12, and 24 months following re-resection and initial surgery. **Results:** Fourteen articles were included for analysis (3048 patients). Meta-analysis showed improved overall survival following re-resection at 6- (OR 1.73, 95% CI 1.23-2.45, p<0.05), 12- (OR 1.71, 95% CI 1.20-2.45, p<0.05), and 24-months (OR 2.24, 95% CI 1.01-4.95, p<0.05). Overall survival from diagnosis or first surgery was also improved in patients who underwent re-resection at recurrence, similarly at 6- (OR 8.22, 95% CI 5.23-12.93, p<0.01), 12- (OR 4.16, 95% CI 3.25-5.36, p<0.01), and 24- (2.35, 95% CI 1.77-3.11, p<0.05) months. Subgroup analyses were done for patients stratified by age, performance status, and number of re-resections. **Conclusions:** Repeat surgery for recurrent glioblastoma is associated with a significant survival advantage independent of other salvage therapies that include chemotherapy, radiation, and other antineoplastic regimens.

P.050

NICO-assisted neuroendoscopic management of enlarging subependymal giant cell astrocytoma in tuberous sclerosis complex: a case report

A Dakson (Halifax) P McNeely (Halifax)*

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Background: Tuberous sclerosis complex (TSC) is an autosomal dominant neurocutaneous syndrome classically associated with mental disability, seizure disorder and adenoma sebaceum, among other anomalies. One of the major causes of mortality and

morbidity in adults is the exclusive occurrence of subependymal giant cell astrocytoma (SEGA) which responds in at least 35% of cases to everolimus, mTOR inhibitor. However, drug treatment is associated with 33% rate of adverse events and requires long-term treatment **Methods:** In this report, we present a case of 49-year old female with TSC and a left enlarging SEGA that was approached endoscopically in order to minimize morbidity associated with open surgical approaches. **Results:** The use of NICO Myriad system is described in this case to achieve successful tumor debulking without post-operative neurologic morbidity. **Conclusions:** This report reveals the value of minimally invasive neuroendoscopic techniques in the management of challenging intraventricular tumors while avoiding injury to crucial deep venous structures.

P.051

5-hydroxymethylcytosine profiling identifies differential targeting in IDH1 mutant versus IDH1 wild-type high-grade gliomas

*W Glowacka (Toronto) H Jain (Toronto) M Okura (Tokyo) A Maimaitiming (Toronto) R Nejad (Toronto) M Yasin (Toronto) H Farooq (Toronto) K Aldape (Toronto) PN Kongkham (Toronto)**

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Background: Gliomas demonstrate epigenetic dysregulation highlighted by the Glioma CpG-Island Methylator Phenotype (G-CIMP) seen in *IDH1* mutant tumors. *IDH1* mutation perturbs the balance between 5-methylcytosine (5mC) and 5-hydroxymethylcytosine (5hmC) by inhibiting TET-mediated active demethylation. The role 5hmC plays in *IDH1* mutant tumors remains poorly understood. **Methods:** We profiled 5hmC in high grade *IDH1* mutant (n = 12) and wild-type (n = 9) tumors on the Illumina MethylationEPIC Beadchip. We examined regions with high 5hmC abundance (top 1% probes), and differentially hydroxymethylated regions (DHMR). 5hmC profiles were correlated with gene expression. **Results:** Mean 5hmC b-values were 4.6%% and 3.8% for *IDH1* mutant and wild-type tumors, respectively. Top 1% and DHMR probes demonstrated *increased* 5hmC among *IDH1* mutants. 5hmC enriched for enhancer and super-enhancers. Among G-CIMP target genes, 22/50 were hydroxymethylated in our *IDH1* mutant cohort, suggesting that 5hmC contributes to their overall methylation. Gene expression was associated with gene body 5hmC. 48 genes differentially expressed between *IDH1* cohorts showed a positive Spearman correlation between 5hmC and gene expression, in particular for genes upregulated in *IDH1* mutants. **Conclusions:** Locus-specific gain of 5hmC, targeting regulatory regions and associated with over-expressed genes, suggests a significant role for 5hmC in *IDH1* mutant HGG.

P.052

Case Report: Brentuximab associated toxic neuropathy

G Hunter (Saskatoon) E Omene (Saskatoon)*

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Background: A 28 year old male with a previous diagnosis of Ewing's Sarcoma in 2008, and a revised diagnosis to Hodgkin's lymphoma in 2016, presented to the Neurology service 6 months after starting the novel monoclonal antibody, Brentuximab. Concurrent therapy included adriamycin, vincristine and daunorubicin. He was referred for progressive weakness and sensory symptoms starting in the legs and spreading to the arms over 6 months. **Methods:** Examination demonstrated distal symmetric weakness with power of 3 proximally and distally in the lower extremities. Reflexes were absent at the ankles and severely reduced at the patella. Gait was consistent with a sensory ataxia, and there was pseudoathetosis of the left hand. **Results:** MRI demonstrated no relevant abnormalities. Electrophysiology was consistent with a motor predominant, distal symmetric sensorimotor axonal neuropathy. **Conclusions:** A review of the literature demonstrated that the monoclonal antibody brentuximab has a high incidence (48%; n = 89) of a reversible distal symmetric polyneuropathy. The mechanism likely relates to microtubule dysfunction by the conjugated compound monomethyl auristatin E. This case adds to the existing body of literature around a severe but potentially reversible neuropathy, resulting from the new monoclonal antibody brentuximab, which may also serve as a model of disease in neuropathy with a well elucidated mechanism of toxicity.

P.053

Expanded endoscopic endonasal approach for petrous apex lesions: our clinical experience and surgical techniques

F Alkherayf (Ottawa) S Kilty (Ottawa)*

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Background: Traditionally petrous apex lesions surgical approach is associated with multiple complications including brain injury secondary to brain retraction. Expanded endoscopic endonasal trans-clival (EEET) can be used in selected patients with minimal complications. **Methods:** We are presenting our experience over the last three years in patients who underwent EEET resection of petrous apex lesions: 8 patients underwent such procedure. All patients underwent extensive workup including MRI and CTA to identify the relation of the carotid to the lesion. All surgeries were done with neuro-physiological monitoring. Intraoperative neuronavigation and endoscopic Doppler were used to identify the petrous segment of the internal carotid artery. Our follow up ranged from 6 months to 2.5 years. **Results:** All patients presented with severe neurologic symptoms related to either fifth cranial nerve, sixth cranial nerve or brain stem compression. Pathologies included chondrosarcoma, cholesterol granulomas and lymphangioma. All patients demonstrated improvement in their symptoms. None of our patients had intraoperative vascular injury. There was no post-operative CSF leak or infection. Postoperative imaging demonstrated excellent resection with no clear residual. Three patient required adjuvant stereotactic radiosurgery because of their underlying pathology. **Conclusions:** The expanded endoscopic endonasal approach for petrous apex lesion should be considered as a minimally invasive approach in selected cases.