

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

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doi: 10.1017/cjn.2018.149

**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 gliomas – a prospective clinical study

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doi: 10.1017/cjn.2018.150

**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

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doi: 10.1017/cjn.2018.151

**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

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doi: 10.1017/cjn.2018.152

**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