second-order features using gray-level co-occurrence matrices. We divided the 195 second level features by the volumes of each ROI to generate another 195 volume-independent features and 2,400 features total. We removed all highly correlated features, performed feature selection with Least Absolute Shrinkage and Selection Operator (LASSO), and built a model using gradient boosting. We split the cohort into 80% training and 20% testing with 5-fold cross-validation. We report area under the curve (AUC) for classifying each tumor type against all others (i.e., BM versus PCNSL and GBM).

RESULTS: LASSO identified 173 independent features, of which 35 most relevant were used for model building. Our three-classification model robustly differentiated (p < 0.001) between PCNSL (AUC 0.95), GBM (AUC 0.93), and BM (AUC 0.93). Our accuracy was 84% and we achieved favorable sensitivity (PCNSL 0.74; GBM 0.73; BM 0.91) and specificity (PCNSL 0.97; GBM 0.92; BM 0.83). With a specificity of 1 (i.e., never incorrectly classifying a tumor subtype), the sensitivity for PCNSL and BM was over 40% and approached 80% for GBM.

CONCLUSION: MRI radiomic analysis may achieve enough classification accuracy to allow for avoidance of intracranial biopsy in select patients and differentiate between PCNSL, GBM, and BM.

349 Locally Recurrent GBM Treated with Resection and Immediate Initiation of Radiation Therapy: Results from a Prospective Trial

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INTRODUCTION: Treatment for recurrent GBM remains problematic. Resection (R) alone is insufficient, and survivals achieved with systemic therapy with or without radiation therapy (RT) are typically <1 year.

METHODS: From 2/2013-2/2018, locally recurrent GBM were treated in a single arm trial (ClinicalTrials.gov, NCT#03088579) of R plus implantation of a surgically targeted radiation therapy (STaRT) device utilizing Cs-131 in bioresorbable collagen tiles (GammaTile, GT Medical Technologies, Tempe AZ USA).

RESULTS: 28 patients (pts) were treated, 20 at first recurrence (range 1-3), Median age 58 (range 21-80), KPS 80 (60-100), female:male ratio 10:18. Median OS 10.7 mo., radiographic LC 8.8 mo., and no first failure was local. MGMT, KPS, and sex were non-predictive. Post hoc analysis disclosed after R+STaRT, 17 pts (54%) received >1 cycle of systemic (Sys) treatment ("Sys+") and 13 pts (46%) did not ("Sys-"). Sys was given as adjuvant, salvage, or both, either alone or in combination. 15 pts received bevacizumab (BEV), 12 temozolomide (TMZ) and 8 lomustine (CCNU). Median OS (mo.) for Sys+ vs. Sys- was 15.1/6.5 (hazard ratio (HR) .38, p = .017); OS for BEV vs. BEV- was 16.7/4.5 (HR .38, p = .017), TMZ+ vs. TMZ- 17.5/6.7 (HR .40, p = .025) and for CCNU+ vs. CCNU- 17.5/7.9 (HR .61, p = .25), respectively. LC was 11.4 mo. for Sys+ vs. 2.1 mo. for Sys- (HR 4.4; p = .16). Three attributed serious AE occurred, 1 wound infection requiring surgery and 2 radiation brain effects, managed medically.

CONCLUSION: Post hoc analysis suggests R+STaRT+Sys may have the potential to impact OS in locally recurrent GBM, possibly by allowing sufficient time for biologically slower but effective treatments to have an impact.

350 Incidence and Long-term Health Care Utilization Associated with Pseudomeningocoele Repair Following Vestibular Schwanomma Resection: A National Database Analysis

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INTRODUCTION: Long-term health care utilization of patients who developed CSF leak and Pseudomeningocoele (PSM) following Vestibular Schwanomma (VS) surgery is not well defined.

METHODS: MarketScan database were queried using the International Classification of Diseases, Ninth and Tenth Revisions and Current Procedural Terminology 4, from 2000 to 2018. We included patients 18 years of age with PSM diagnosis with at least 2 years of continuous enrollment. Outcomes analyzed were hospital admissions, outpatient services, medication refills and their associated payments.

RESULTS: Of 1460 patients, 96.6% (n = 1411) had no PSM following surgery for VS, 2.4% (n = 35) were in s-PSM and only 0.95% (n = 14) were in ns-PSM cohorts. Patients in the s-PSM cohort incurred higher hospital readmission rate, outpatient payments compared to those in nd-PSM and ns-PSM cohorts at 6 months, 1-year and 2-years following the following VS resection. At 1-year following VS resection, median combined payments for s-PSM cohort were $74,683 compared to $42,664 for ns-PSM and $9476 for nd-PSM cohort, p < 0.0001. Similarly, at 2-years, median combined payments median combined payments for s-PSM cohort were $83,351 compared to $63,942 for ns-PSM and $18,839 for nd-PSM cohort, p < 0.0001.

CONCLUSION: Patients in s-PSM cohort incurred 8 times and 4.4 times the combined payments at 1- and 2-years respectively compared to nd-PSM cohort. Also, patients in ns-PSM cohort incurred 4.5 times and 3.4 times the payments compared to nd-PSM cohort.

351 Dear Program Director: Evaluating Implicit Bias in Neurosurgery Residency Letters of Recommendation

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INTRODUCTION: Despite comprising half of medical students, women represent 25% of neurosurgery applicants, 17% of residents and 12% of practicing neurosurgeons. This trend suggests “leaks” in the career pipeline for female neurosurgeons.

The NRMP Program Director Survey has shown that neurosurgery programs identify Step 1 score and letters of recommendation (LORs) as the most important factors in selecting applicants to interview. Other specialties have evaluated implicit biases in LORs, but no such study exists in neurosurgery.