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The Impact of Intraoperative MRI and Other Factors on Survival for Patients with Newly Diagnosed Glioblastoma. A Multi Center Assessment of Over 800 Patients

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Introduction

Intra-operative magnetic resonance imaging (iMRI) has been shown to increase rates of gross total resection and overall survival in glioblastoma (GBM) in a series of smaller observational and randomized studies. This study aims to assess parameters affecting survival and other outcomes for patients undergoing craniotomy for newly diagnosed GBM including the impact of iMRI.

Methods

Analysis of a multicenter retrospective/prospective REDCaptm database of over 7500 patients undergoing cranial neurosurgical procedures with or without iMRI at 8 North American centers (1996-2016). Eight-hundred-and-eleven patients were identified that had undergone surgery for newly diagnosed GBM, including 315 surgical resections with iMRI, 348 without iMRI, 148 others, including biopsies and laser interstitial thermotherapy (LITT). Kaplan-Meier analysis and Cox-regression models were used to assess survival. iMRI was performed using a movable ceiling-mounted high-field magnet at the discretion of the operating surgeon.

Results

The use of iMRI trended towards an increased median overall survival (OS) from 14.67 to 17.33 months (p=.18), with an increased proportion receiving gross total resection (GTR, 32.39% versus 41.35%, p=.03; OR=1.479 [1.033, 2.117]). Univariate and multivariate analysis identified the following as correlated with increased (OS): surgical resection versus biopsy, younger age, American Society of Anesthesiologists (ASA) classification, O6-methylguanine-DNA-methyltransferase (MGMT) promoter methylation, use of adjuvant temolozomide and radiation (Stupp protocol), and clinical trial participation. For patients with IDH-1 mutations, iMRI increased progression-free survival (PFS, median 6.967 months non-iMRI versus greater than 36 months iMRI, p=.008) and trended toward increased OS (median 14.67 months versus greater than 36 months, p=0.34).

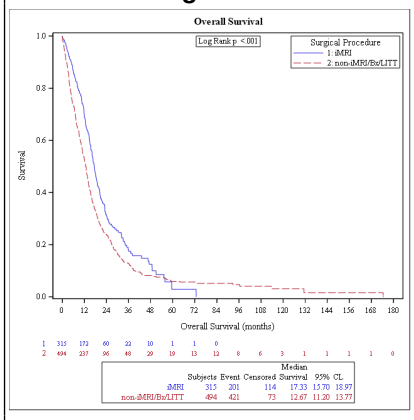
Conclusions

Large multi-center database analysis of newly diagnosed GBM's suggests that use of iMRI during resection increases rates of GTR and may increase OS. Age, ASA status, MGMT promoter methylation, adjuvant chemoradiation, and clinical trial participation are predictors of improved OS. iMRI may be most impactful in patients with IDH-1 mutations.

Learning Objectives

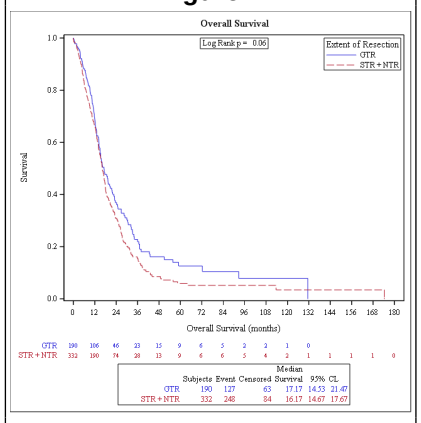
By the conclusion of this session, participants should be able to 1) describe the role of IMRI in the resection of glioblastomas, 2) describe factors affecting overall survival in primary glioblastoma, and 3) discuss potential implications and populations in which IMRI will be particularly impactful.

Figure 1



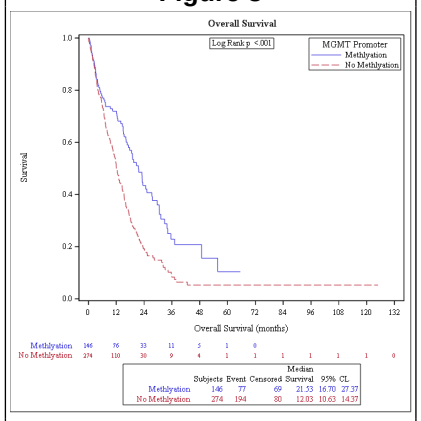
Kaplan-Meier plots showing overall survival for surgical resections with iMRI against non-iMRI resections, LITT, and biopsy (p<.001)

Figure 2



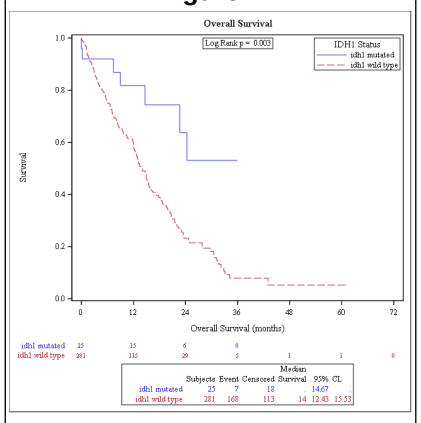
Kaplan-Meier plot of overall survival comparing gross-total resection and sub-total resection (p=.06)

Figure 3



Kaplan-Meier plots showing overall survival for MGMT promoter methylated tumors compared to wild-type (p<.001)

Figure 4



Kaplan Meier plots for IDH-1 mutant tumors compared to wild-type (p<.001)

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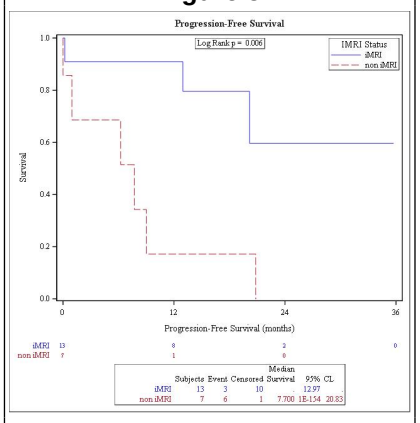
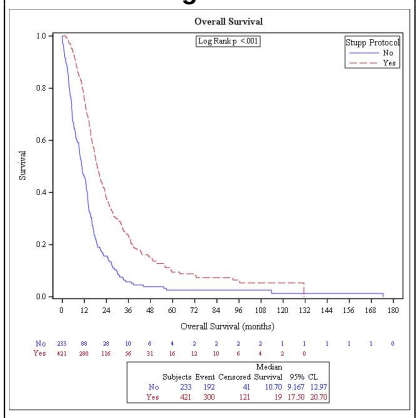
Figure 5



Kaplan-Meier plot of PFS comparing the use of IMRI in IDH1 mutants (p=.006)

Figure 6



Kaplan Meier plot of OS showing patients who received Stupp protocol (adjuvant temozolomide and radiation) and did not (p<.001)