Pretreatment Dynamic Contrast-Enhanced MR Imaging in Glioblastoma : Correlation Study with Genetic Profiles

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Target Audience : Neuroradiologists and neurosurgeons, who are interested in genetic profiles and prognostication of glioblastoma.

Purpose: To evaluate the usefulness of preoperative dynamic contrast-enhanced (DCE) MRI in predicting major genetic profiles in glioblastomas.

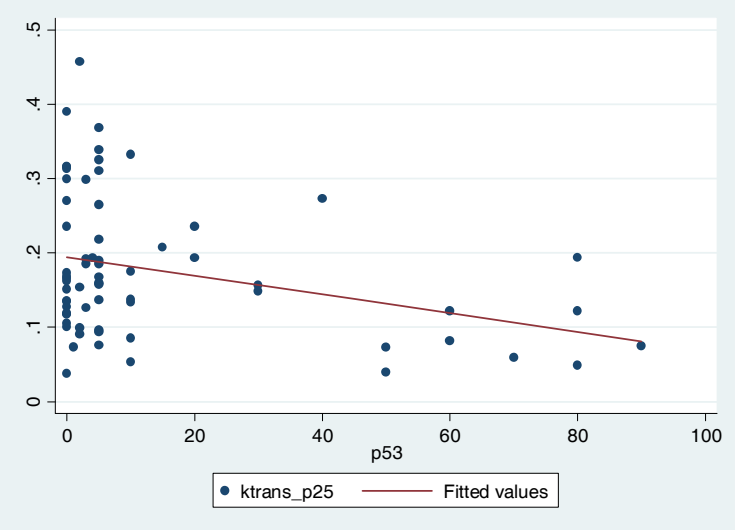
Methods: The 67 patients with newly diagnosed glioblastoma who underwent preoperative DCE-MRI were enrolled. The histogram parameters consisting of mean, minimum, 5th, 25th, 50th, 75th, 95th, maximum values, skewness and kurtosis of DCE-MRI parameters including Ktrans and vp were calculated from the entire enhancing tumors. Three pathologically confirmed genetic profiles including epidermal growth factor receptor (EGFR), p53 and Ki-67 were correlated with the histogram parameters of Ktrans, and vp values using nonparametric Wilcoxon ranksum test and Pearson correlation analysis. ROC analysis was performed with the parameter showing significant difference according EGFR status, and AUC, optimal cutoff, sensitivity and specificity were calculated thereafter.

Results: The histogram parameters of Ktrans showed trend toward higher values in EGFR positive group than in EGFR negative group, which was statistically significant in 5th percentile value. On ROC analysis, AUC, optimal cutoff value, sensitivity, and specificity of 5th percentile Ktrans value in predicting EGFR status were 0.7, 0.07min^{-1}, 56.6% and 64.3%, respectively. Ktrans values were negatively correlated with p53, with statistically significance in 5th, 25th, 50th, 75th and 95th percentile values. Ktrans values were not significantly correlated with Ki-67. vp values were not significantly correlated with any of EGFR, p53 or Ki-67.

Table. Values of DCE parameters according to EGFR expression status

Parameters	EGFR expression (-)	EGFR expression (+)	P value
ktrans_mean	0.21 (0.16 - 0.27)	0.26 (0.19 - 0.37)	0.15
ktrans_skewness	0.79 (0.24 - 1.10)	0.38 (0.18 - 0.68)	0.06
ktrans_kurtosis	3.21 (2.53 - 5.27)	2.70 (2.30 - 3.38)	0.12
ktrans_min	0.00 (0.00 - 0.01)	0.00 (0.00 - 0.02)	0.10
ktrans_p5	0.05 (0.04 - 0.08)	0.09 (0.05 - 0.14)	0.02
ktrans_p25	0.13 (0.09 - 0.17)	0.17 (0.12 - 0.27)	0.06
ktrans_p50	0.20 (0.15 - 0.27)	0.24 (0.17 - 0.39)	0.12
ktrans_p75	0.28 (0.21 - 0.36)	0.34 (0.25 - 0.46)	0.13
ktrans_p95	0.46 (0.36 - 0.48)	0.48 (0.34 - 0.69)	0.33
ktrans_max	0.63 (0.46 - 0.79)	0.62 (0.48 - 0.99)	0.65
vp_mean	15.0 (11.0 - 18.7)	17.9 (12.4 - 23.7)	0.31
vp_skewness	1.4 (1.1 - 2.1)	1.3 (0.8 - 2.0)	0.55
vp_kurtosis	6.0 (4.7 - 9.6)	5.8 (4.0 - 9.1)	0.71
vp_min	0.1 (0.1 - 0.3)	0.4 (0.1 - 1.7)	0.15
vp_p5	4.1 (3.2 - 5.9)	5.7 (3.8 - 8.2)	0.08
vp_p25	8.5 (6.6 - 10.4)	11.0 (7.1 - 14.2)	0.16
vp_p50	12.0 (9.5 - 14.9)	16.2 (10.9 - 21.8)	0.18
vp_p75	18.0 (13.7 - 23.2)	22.1 (14.9 - 28.4)	0.29
vp_p95	34.6 (20.7 - 43.1)	33.5 (21.3 - 45.3)	0.85
vp_max	71.0 (52.6 - 98.1)	72.1 (49.0 - 99.1)	0.96

Figure 1. Scatterplot depicting the correlation between 25th percentile Ktrans value and p53 expression.



Discussion: Assuming that Ktrans reflects vascular permeability and in theory, increases with tumor aggressiveness, association might be expected between high Ktrans values and genetic profiles implicating poor prognosis. However, prognostic value of Ktrans is still controversial and to the best we know, this is the first study to investigate the relationship between Ktrans values and genetic profiles of EGFR, p53, and Ki-67 in glioblastoma. Considering that EGFR overexpression and Ki-67 have been reported to be related to poor prognosis, and p53 is a tumor suppressor gene, our results shows the correlation between high Ktrans values and genetic profiles implicating poor prognosis in glioblatomsas.

Conclusion: We found that Ktrans were higher in EGFR positive tumors than in EGFR negative tumors and negatively correlated with p53, thus associated with genetic profiles implicating poor prognosis in glioblastomas. We suggest that DCE-MRI might be useful in predicting genetic profiles associated with prognosis, and determining appropriate treatment strategy in patients with glioblastoma.

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