On-line Table 1: Full search strategy[a]

Data Bases	Terms
PubMed/MEDLINE	
MeSH terms	glioma perfusion, magnetic resonance imaging, astrocytoma, oligodendroglioma
Other search terms	grade, grading, DSC, oligoastrocytoma
Hits	1458
EMBASE	
P	glioma, brain glioma, cerebral glioma, glia tumor, glia tumour, glial tumor, glial tumour, high grade glioma, low grade glioma
I	perfusion-weighted imaging, perfusion MRI, perfusion magnetic resonance imaging, perfusion-weighted MRI, perfusion-weighted magnetic resonance, perfusion-weighted magnetic resonance imaging
C	histopathology, neuropathology, histopathological study, neurohistopathology
O	NA
Hits	172
Web of Science	
Search terms	glioma, perfusion, magnetic resonance imaging
Hits	283
ClinicalTrials.gov	
Search terms	glioma, perfusion
Hits	64

Note:—P indicates patient; I, intervention; C, comparison; O, outcome; MeSH, Medical Subject Heading; NA, not applicable.
[a] The search was performed in October 2016.

On-line Table 2: References of included studies in the meta-analysis (*n* = 28)

No.	First 3 Authors	Journal, Year, Edition, Pages
1	Bisdas S, Kirkpatrick M, Giglio P, et al	*AJNR American Journal of Neuroradiology* 2009;30:681–88
2	Blasel S, Franz K, Mittelbronn M, et al	*Neurosurgical Review* 2010;33:193–203; discussion 203–194
3	Boxerman JL, Schmainda KM, Weisskoff RM	*AJNR American Journal of Neuroradiology* 2006;27:859–67
4	Catalaa I, Henry R, Dillon WP, et al	*NMR in Biomedicine* 2006;19:463–75
5	Caulo M, Panara V, Tortora D, et al	*Radiology* 2014;272:494–503
6	Chaskis C, Stadnik T, Michotte A, et al	*Acta Neurochirurgica* 2006;148:277–85; discussion 285
7	Cuccarini V, Erbetta A, Farinotti M, et al	*Journal of Neuro-Oncology* 2016;126:279–88
8	Falk A, Fahlström M, Rostrup E, et al	*Neuroradiology* 2014;56:1031–38
9	Fellah S, Caudal D, De Paula AM, et al	*AJNR American Journal of Neuroradiology* 2013;34:1326–33
10	Hakyemez B, Erdogan C, Ercan I, et al	*Clinical Radiology* 2005;60:493–502
11	Hilario A, Ramos A, Perez-Nuñez A, et al	*AJNR American Journal of Neuroradiology* 2012;33:701–07
12	Kapoor GS, Gocke TA, Chawla S, et al	*Journal of Neuro-Oncology* 2009;92:373–86
13	Kim H, Choi SH, Kim JH, et al	*PLoS One* 2013;8:e63462
14	Law M, Young R, Babb J, et al	*AJNR American Journal of Neuroradiology* 2007;28:761–66
15	Lee SJ, Kim JH, Kim YM, et al	*Korean Journal of Radiology* 2001;2:1–7
16	Maia AC Jr, Malheiros SM, da Rocha AJ, et al	*AJNR American Journal of Neuroradiology* 2005;26:777–83
17	Nguyen TB, Cron GO, Perdrizet K, et al	*AJNR American Journal of Neuroradiology* 2015;36:2017–22
18	Preul C, Kühn B, Lang EW, et al	*European Journal of Radiology* 2003;48:244–51
19	Sadeghi N, Salmon I, Tang BN, et al	*Journal of Magnetic Resonance Imaging* 2006;24:989–94
20	Saito T, Yamasaki F, Kajiwara Y, et al	*European Journal of Radiology* 2012;81:1863–69
21	Santarosa C, Castellano A, Conte GM, et al	*European Journal of Radiology* 2016;85:1147–56
22	Server A, Graff BA, Orheim TE, et al	*Neuroradiology* 2011;53:435–47
23	Sugahara T, Korogi Y, Kochi M, et al	*AJR American Journal of Radiology* 1998;171:1479–86
24	Svolos P, Tsolaki E, Kapsalaki E, et al	*Magnetic Resonance Imaging* 2013;31:1567–77
25	Thomsen H, Steffensen E, Larsson EM, et al	*Acta Radiologica* 2012;53:95–101
26	Tietze A, Mouridsen K, Lassen-Ramshad Y, et al	*PLoS One* 2015;10:e0123044
27	Wang XC, Zhang H, Tan Y, et al	*Journal of Magnetic Resonance Imaging* 2014;39:1569–74
28	Weber MA, Zoubaa S, Schlieter M, et al	*Neurology* 2006;66:1899–1906

On-line Table 3: Results from QUADAS-2 assessment

Study Identification		Risk of Bias				Applicability Concerns		
First author	Year Published	Patient Selection[a]	Index Test[b]	Reference Standard[c]	Flow and Timing	Patient Selection	Index Test	Reference Standard
Bisdas	2009	+	+	0	0	+	+	+
Blasel	2010	+	0	0	0	+	+	+
Boxerman	2006	0	0	0	0	+	−	+
Catalaa	2006	0	0	+	0	+	+	+
Caulo	2014	+	+	0	0	+	+	+
Chaskis	2006	+	0	+	0	+	+	+
Cuccarini	2016	+	+	0	+	+	+	+
Falk	2014	+	+	0	−	+	−	+
Fellah	2013	+	+	0	0	+	+	+
Hakyemez	2005	+	−	0	0	+	+	+
Hilario	2012	+	−	0	0	+	+	+
Kapoor	2009	+	−	0	0	+	+	+
Kim	2013	+	+	0	0	+	−	+
Law	2007	+	−	0	0	+	+	+
Lee	2001	+	−	0	0	+	+	+
Maia	2005	+	0	+	0	+	+	+
Nguyen	2015	+	+	0	+	+	+	+
Preul	2003	0	+	+	+	+	+	+
Sadeghi	2006	+	0	0	0	+	+	+
Saito	2012	+	+	+	0	+	+	+
Santarosa	2016	0	+	0	0	+	+	+
Server	2011	+	+	0	0	+	+	+
Sugahara	1998	+	+	0	+	+	+	+
Svolos	2013	+	+	0	+	+	+	+
Thomsen	2012	+	0	0	0	+	+	+
Tietze	2015	+	−	0	+	+	+	+
Wang	2014	0	−	0	0	+	+	+
Weber	2006	+	+	0	+	+	+	+

[a] Positive (+) if consecutive or if the patient selection was adequately explained and a time frame for inclusion was reported. Negative (−) if no information about consecutive enrollment and no time frame were reported. Indeterminate (0) if only time frame was reported.

[b] Positive if reported blinded to index test. Negative if reported unblinded to index test. Indeterminate if no information regarding blinding was reported.

[c] Positive if blinded for reference standard test result. Negative if no information of blinding procedure and if cutoff determination was from actual study data and not a previously set standard. Indeterminate if no information regarding blinding and no calculation of ROC were reported.

On-line Table 4: Included studies[a]

ID	First Author	Year	Study Period	Region	Perfusion Method	Sequence	Scanner	MRI	Glioma Classification	Prospective/ Retrospective	WHO Grade II (No.)	WHO Grade III (No.)	Glioma Types	ROI Method	Pre-saturation of Tissue (Y/N)	Mathematic Correction for Contrast Agent Leakage (Y/N)	Discrimination between Grades II and III in the Individual Studies? (Y/N)	rCBVmax Mean (SD) Grade II	rCBVmax Mean (SD) Grade III	Published Patient Data (Y/N)
1	Bisdas	2009	2002–2007	US	DSC	GE-EPI	Intera, Philips[b]	1.5T	WHO NOS	Retrospective	15	7	AC/OA/OD	rCBVmax	N	NA	N	2.93 (1.95)	3.26 (2.65)	Y
2	Blasel	2010	2007–2008	Germany	DSC	GE-EPI	Allegra, Siemens[c]	3T	WHO NOS	Retrospective	12	12	AC/OA/OD	rCBVmax	N	NA	N	4.24 (2.67)	4.39 (2.45)	N
3	Boxerman	2006	NA	US	DSC	GE-EPI	Signa, GE[d]	1.5T	WHO1993	NA	9	9	AC/OA/OD	rCBVmax	Y	Y, Boxerman	Y	1.39 (0.86)	2.84 (143)	Y
4	Catalaa	2006	NA	US	DSC	GE-EPI	GE scanner	1.5T	WHO NOS	NA	8	9	NA	Histogram analysis, relative 75th percentile CBV	N	Y, Boxerman	N	1.81 (0.60)	1.80 (0.94)	N
5	Caulo	2014	2008–2012	Italy	DSC	GE-EPI	Achieva, Philips	3T	WHO 2007	Retrospective	33	17	AC/OA/OD	rCBVmax	Y	NA	N	1.57 (1.00)	2.43 (179)	N
6	Chaskis	2006	NA	Belgium	DSC	GE-EPI	Vision, Siemens	1.5T	WHO 2000	Prospective	9	9	AC/OA/OD	rCBVmax	N	NA	Y	1.21 (0.62)	2.44 (120)	N
7	Cuccarini	2016	2006–2009	Italy	DSC	DSC NOS	Avanto, Siemens	1.5T	WHO 2007	Prospective	40	19	AC/OA/OD	rCBVmax	Y	NA	N	1.60 (1.50)	1.60 (0.90)	N
8	Falk	2014	2010–2012	Sweden	DSC	GE-EPI	Achieva, Philips	3T	WHO 2007	Prospective	18	7	AC/OA/OD	Histogram analysis, relative 90th percentile CBV	Y	Y, Boxerman	N	1.67 (0.78)	2.91 (179)	Y
9	Fellah	2013	2006–2010	France	DSC	GE-EPI	Symphony, Siemens	1.5T	WHO 2007	Retrospective	24	26	OA/OD	rCBVmax	N	Y	Y	1.57 (0.82)	3.89 (197)	N
10	Hakyemez	2005	2002–2003	Turkey	DSC	GE-EPI	Signa, GE	1.5T	WHO NOS	Prospective	8	4	AC/OA/OD	rCBVmax	Y	NA	Y	1.51 (0.37)	5.46 (185)	Y
11	Hilario	2012	2006–2010	Spain	DSC	GE-EPI	Signa, GE	1.5T	WHO 2007	Retrospective	32	29	AC/OA/OD	rCBVmax	Y	NA	Y	2.36 (1.44)	3.77 (2.82)	N
12	Kapoor	2009	2003–2008	US	DSC	GE-EPI	Tim Trio, Siemens	1.5T or 3T	WHO NOS	Retrospective	14	15	OA/OD	rCBVmax	Y	NA	Y	1.89 (0.97)	3.26 (2.23)	Y
13	Kim	2013	2010–2012	South Korea	DSC	GE-EPI	Verio, Siemens	3T	WHO NOS	Retrospective	9	16	AC	Histogram analysis, relative 99th percentile CBV	N	Y, Boxerman	N	3.55 (0.55)	4.16 (142)	N
14	Law	2007	1999–2003	US	DSC	GE-EPI	Sonata Vision, Avanto/ Symphony, Siemens	1.5T	WHO NOS	Retrospective	31	30	AC	rCBVmax	N	NA	Y	1.51 (0.64)	5.03 (3.47)	N
15	Lee	2001	NA	Korea	DSC	GE-EPI	63SP system, Siemens	1.5T	WHO1993	Retrospective	4	9	AC/OA/OD	rCBVmax	N	NA	Y	1.75 (1.51)	3.97 (0.56)	Y
16	Maia	2005	2001–2004	Brazil	DSC	SE-EPI	NA	1.5T	WHO 2000	NA	14	7	AC/OA/OD	rCBVmax	N	N	Y	1.39 (0.74)	3.48 (0.35)	Y
17	Nguyen	2015	2011–2013	Canada	DSC	GE-EPI	Tim Trio, Siemens	3T	WHO 2007	Prospective	9	11	AC/OA	rCBVmax	Y	Y, Boxerman	N	2.38 (11.30)	5.04 (7.38)	N
18	Preul	2003	NA	Germany	DSC	GE-EPI	Magnetom, Siemens	1.5T	WHO NOS	Prospective	3	13	AC/OA	rCBVmax	N	N	Y	1.27 (0.76)	3.97 (123)	Y
19	Sadeghi	2006	NA	Belgium	DSC	GE-EPI	Gyroscan NT, Philips	1.5T	WHO1993	NA	8	3	AC/OA/OD	rCBVmax	N	NA	N	2.49 (1.20)	4.61 (3.37)	Y
20	Saito	2012	2006–2009	Japan	DSC	GE-EPI	Signa, GE	3T	WHO 2007	Retrospective	13	11	AC/OA/OD	rCBVmax	Y	Y, Boxerman	Y	4.11 (1.88)	4.45 (198)	Y
21	Santarosa	2016	NA	Italy	DSC	GE-EPI	Achieva, Philips	3T	WHO 2007	Prospective	9	4	AC/OA/OD	rCBVmax	N	Y, Boxerman	Y	1.20 (1.05)	6.40 (120)	N
22	Server	2011	NA	Norway	DSC	GE-EPI	Signa, GE	3T	WHO 2007	Prospective	18	14	AC/OA/OD	rCBVmax	N	Y, Boxerman	Y	2.42 (1.17)	5.46 (2.17)	N
23	Sugahara	1998	1996–1997	Japan	DSC	GE-EPI	Magnetom, Siemens	1.5T	WHO1993	Prospective	4	14	AC/OA/OD	rCBVmax	Y	NA	Y	1.26 (0.55)	4.61 (133)	N
24	Svolos	2013	NA	Greece	DSC	GE-EPI	Signa, GE	3T	NA	Prospective	13	12	NA	rCBVmax	Y	NA	Y	2.33 (0.79)	4.32 (106)	N
25	Thomsen	2012	2006–2008	Denmark	DSC	GE-EPI	Signa, GE	1.5T or 3T	WHO 2007	Retrospective	2	4	AC	rCBVmax	N	Y, Boxerman	N	4.40 (5.20)	4.13 (3.91)	N
26	Tietze	2015	2010–2012	Denmark	DSC	GE-EPI	Achieva, Philips	3T	NA	Retrospective	3	5	OD	rCBVmax	Y	Y, Mouridsen[f]	N	4.06 (3.09)	4.48 (2.22)	N
27	Wang	2014	NA	China	DSC	GE-EPI	Avanto, Siemens	1.5T	WHO 2007	Retrospective	18	11	AC	rCBVmax	N	NA	Y	1.27 (0.44)	4.01 (2.20)	N
28	Weber	2006	NA	Germany	DSC	GE-EPI	Edge, Marconi[e]	1.5T	WHO NOS	Prospective	9	11	NA	rCBVmax	N	NA	N	0.80 (0.50)	1.70 (0.90)	N

Note:—AC indicates astrocytoma; OA, oligoastrocytoma; OA, oligoastrocytoma; OD, oligodendroglioma; NOS, not otherwise specified; NA, not available; ID, identification; Y, yes; N, no; GE-EPI, gradient-echo-EPI; SE-EPI, spin-echo-EPI.

[a] Details of these studies are found in the on-line tables.

[b] Philips Healthcare, Best, the Netherlands.

[c] Erlangen, Germany.

[d] GE Healthcare, Milwaukee, Wisconsin.

[e] Marconi Medical Systems, Highland Heights, Ohio.

[f] Mouridsen K, Hansen MB, Ostergaard L, et al. **Reliable estimation of capillary transit time distributions using DSC-MRI.** J Cereb Blood Flow Metab 2014;34:1511–21 CrossRef Medline

On-line Table 5: Individual patient data

Study	WHO Grade	rCBVmax
Bisdas	II	1.10
	II	2.10
	II	3.00
	II	4.80
	II	1.20
	II	6.20
	II	6.10
	II	2.90
	II	1.10
	II	5.60
	II	4.10
	II	1.00
	II	1.10
	II	1.30
	II	2.40
	III	1.20
	III	2.70
	III	6.20
	III	1.20
	III	2.20
	III	7.80
	III	1.50
Boxerman	II	1.56
	II	1.46
	II	0.72
	II	1.39
	II	1.35
	II	3.35
	II	0.44
	II	1.61
	II	0.62
	III	3.44
	III	0.74
	III	5.63
	III	4.28
	III	2.42
	III	2.02
	III	2.18
	III	2.25
	III	2.63
Falk	II	1.41
	II	2.01
	II	4.23
	II	1.64
	II	1.87
	II	2.59
	II	1.71
	II	1.12
	II	1.54
	II	1.16
	II	1.08
	II	1.90
	II	1.28
	II	1.08
	II	2.09
	II	0.94
	II	1.30
	II	1.08
	III	5.76
	III	1.04
	III	1.91
	III	2.24
	III	5.13
	III	2.38
	III	1.90

On-line Table 5: Continued

Study	WHO Grade	rCBVmax
Hakyemez	II	0.97
	II	1.73
	II	1.84
	II	0.98
	II	1.98
	II	1.46
	II	1.58
	II	1.55
	III	6.34
	III	3.74
	III	7.64
	III	4.12
Kapoor	II	1.95
	II	1.79
	II	1.14
	II	1.25
	II	3.55
	II	2.31
	II	3.03
	II	2.47
	II	2.96
	II	0.52
	II	2.59
	II	0.41
	II	0.89
	II	1.61
	III	1.83
	III	5.28
	III	3.71
	III	1.27
	III	2.08
	III	1.10
	III	5.57
	III	8.74
	III	3.20
	III	1.34
	III	1.28
	III	4.79
	III	1.40
	III	2.24
	III	5.04
Lee	II	1.79
	II	0.39
	II	3.85
	II	0.97
	III	5.11
	III	4.56
	III	3.67
	III	4.15
	III	3.40
	III	3.96
	III	3.46
	III	3.62
	III	3.78
Maia	II	0.77
	II	0.72
	II	0.70
	II	0.81
	II	0.65
	II	2.10
	II	1.20
	II	1.90
	II	0.82
	II	1.62
	II	1.88

On-line Table 5: Continued

Study	WHO Grade	rCBVmax
	II	1.97
	II	2.99
	III	3.11
	III	3.08
	III	3.60
	III	3.90
	III	3.70
	III	3.80
	III	3.19
Preul	II	1.10
	II	2.10
	II	0.60
	III	3.50
	III	5.50
	III	2.10
	III	4.40
	III	4.20
	III	3.90
	III	3.50
	III	6.00
	III	2.50
	III	2.30
	III	4.10
	III	5.60
	III	4.00
Sadeghi	II	1.93
	II	0.92
	II	1.81
	II	2.32
	II	3.82
	II	4.00
	II	1.41
	II	3.72
	III	8.50
	III	2.83
	III	2.50
Saito	II	1.03
	II	1.86
	II	1.21
	II	5.60
	II	5.72
	II	4.02
	II	3.52
	II	4.63
	II	2.93
	II	5.12
	II	6.60
	II	6.19
	II	5.06
	III	2.12
	III	2.85
	III	2.03
	III	2.25
	III	5.00
	III	4.04
	III	4.22
	III	6.23
	III	6.46
	III	7.55
	III	6.23

On-line Table 6: Data from cross-tabulation on 10 studies presenting individual patient data

Study ID	First Author, Year	TP	FN	FP	TN
Study 1	Bisdas 2009	2	5	1	14
Study 2	Boxerman 2006	8	1	1	8
Study 3	Falk 2014	6	1	4	14
Study 4	Hakyemez 2005	4	0	0	8
Study 5	Kapoor 2009	7	8	1	13
Study 6	Lee 2001	9	0	1	3
Study 7	Maia 2005	7	0	0	13
Study 8	Preul 2003	13	0	1	2
Study 9	Sadeghi 2006	1	2	0	8
Study 10	Saito 2012	4	7	1	12

Note:—TP, true-positive; FN, false-negative; FP, false-positive; TN, true-negative.