BIOGRAPHICAL SKETCH

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NAME: Barboriak, Daniel Paul

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POSITION TITLE: Professor of Radiology

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Wisconsin-Madison	B.S.	05/81	Molecular Biology / English
Harvard Medical School, Boston, MA	M.D.	05/86	Medicine

A. Personal Statement

I have specific expertise in clinical neuroradiology, having earned subspecialty board Certificate of Added Qualifications in the field, and having gained over twenty years of clinical experience as a Senior Member of the American Society of Neuroradiology. Additionally, I have developed an academic interest in the imaging evaluation of cancer therapeutics, and established a lab focused on the study of imaging in neuro-oncology in 2006 (https://sites.duke.edu/dblab/). My lab has gained in serving as an imaging core lab for multi-center imaging trials being performed through the aegis of ACRIN (American College of Radiology Imaging Network) and pharmaceutical companies. These trials require close collaboration between me and the imaging staff at the trial sites in order to track each patient, perform quality control on the images obtained, derive quantitative metrics from the imaging data, and guide the data analysis in order to shape the results into scientific presentations and abstracts. I also serve as Chairman of the ACRIN Head and Neck / Neuro committee and Imaging co-chair of the ECOG-ACRIN Brain Tumor Working Group. In this role I collaborate in developing the imaging components for clinical trials developed within ECOG-ACRIN and I am primarily responsible for the development and supervision of primary imaging multicenter trials for brain tumors within the NCI's National Clinical Trials Network.

B. Positions, Scientific Appointments, and Honors

Positions and Employment

2013-Present Director of Radiology Clinical Research Unit, Duke University Medical Center, Durham, NC
2012-Present Professor of Radiology, Duke University Medical Center, Durham, NC
2015-2020 Vice-Chair for Academic Affairs, Department of Radiology, Duke University Medical Center, Durham, NC
2007-2012 Director, Pediatric Neuroradiology, Duke University Medical Center, Durham, NC
2007-2012 Associate Professor in Pediatrics, Duke University Medical Center, Durham, NC
2004-2012 Associate Professor of Radiology, Duke University Medical Center, Durham, NC
1997-2004 Assistant Professor of Radiology, Duke University Medical Center, Durham, NC
1996-1997 Assistant Clinical Professor of Radiology, Duke University Medical Center, Durham, NC
1990-1992 Fellowship, Neuroradiology, Massachusetts General Hospital
1987-1992 Clinical Fellow in Radiology, Harvard Medical School, Boston, MA

1987-1991 Residency, Radiology, Massachusetts General Hospital
1986-1987 Internship, Waterbury Hospital

Other Experience and Professional Membership

9/2021–Present Board member, ECOG-ACRIN Medical Research Foundation
11/2019-Present Fellow of the American Society of Functional Neuroradiology
6/2018-Present Member the American College of Radiology Neuro Research Commission
7/2018-Present Member of Organizing Committee ASNR/ASFNR Artificial Intelligence Task Force and faculty, ASNR/ASFNR AI Workshop
4/2017-12/2019 Co-chair of RSNA Quantitative Biomarkers Alliance Perfusion, Diffusion and Flow MRI Biomarker Committee
4/2017-7/2019 Member, Artificial Intelligence Advisory Group for American College of Radiology
7/2016-12/2019 Member, fNIH / Biomarkers Consortium, Neurosciences Steering Committee
7/2014-Present Member, Brain Malignancy Steering Committee. Coordinating Center for Clinical Trials, National Cancer Institute
3/2012-3/2013 President, American Society of Functional Neuroradiology
8/2011-Present Chairman, ACRIN Neuro / Head and Neck Committee, now Vice Chair for Imaging, Brain Tumor Working Group, ECOG-ACRIN
7/2007-11/2009 Advisor to NCI CIP RIDER (Reference Imaging Database to Evaluate Response) project
2/2006-8/2011 Member, ACRIN Neuro / Head and Neck Committee
8/1995-Present Member, Radiological Society of North America
8/1991-Present Member, American Society of Neuroradiology

C. Contributions to Science

1. Leadership of ACRIN and ECOG-ACRIN brain tumor trials. Multicenter clinical imaging trials play a key role in the process of bringing innovations in imaging into clinical practice. For the past several years, I have served as chair of the American College of Radiology Imaging Network (ACRIN) Head and Neck/Neuro Committee and, under the NCI National Clinical Trials Network, co-chair of the ECOG-ACRIN Brain Tumor Working Group, and have overseen the analysis of results from the ACRIN 6677 and 6686 trials.

These multicenter trials demonstrated that after patients with recurrent glioblastomas are treated with bevacizumab, recurrence of tumor-related contrast enhancement is associated with poor survival, while increase in FLAIR signal abnormality was not associated with similarly poor prognosis. Diffusion weighted imaging has long been of interest for use in this setting; results of ACRIN 6677 show that maintenance of sufficient image quality will be a key step that needs to be achieved before this technique can be validated through a multicenter trial (a). ACRIN 6677 was also one of the first trials to highlight the possible utility of MR spectroscopy in the multicenter setting (b). Finally, this trial showed that changes in cerebral blood volume measured using dynamic susceptibility contrast-enhanced MRI in scans obtained two weeks after initiation of anti-angiogenic therapy were useful for predicting survival. This finding raises the possibility that this technique can be used to identify a subgroup of patients in whom anti-angiogenic therapy is associated with improved survival (c). This concept is now being evaluated in the multicenter primary imaging trial EAF151: Change in Relative Cerebral Blood Volume as a Biomarker for Early Response to Bevacizumab in Patients with Recurrent Glioblastoma. We are currently in the planning stages for a primary imaging trial called the Glioblastoma Accelerated Biomarker Learning Environment (GABLE) trial to distinguish true progression from pseudoprogression in patients with newly diagnosed glioblastoma (d).

My lab has also performed image analysis for dynamic contrast-enhanced MRI for these trials and for ACRIN 6684, which integrates advanced MR imaging with PET imaging for hypoxia in patients presenting with high-grade glioma. Our publications also explore the utility of both conventional and advanced biomarkers for evaluations of patients with newly diagnosed GBM.

a. Ellingson BM, Kim E, Woodworth DC, Marques H, Boxerman JL, Safriel Y, McKinstry RC, Bokstein F, Jain R, Chi TL, Sorensen AG, Gilbert MR, **Barboriak DP**. Diffusion MRI quality control and functional diffusion

map results in ACRIN 6677/RTOG 0625: a multicenter, randomized, phase II trial of bevacizumab and chemotherapy in recurrent glioblastoma. Int J Oncol. 2015 May;46(5):1883-92. PMCID: PMC4383029

b. Ratai EM, Zhang Z, Snyder BS, Boxerman JL, Safriel Y, McKinstry RC, Bokstein F, Gilbert MR, Sorensen AG, **Barboriak DP**. Magnetic resonance spectroscopy as an early indicator of response to anti-angiogenic therapy in patients with recurrent glioblastoma: RTOG 0625/ACRIN 6677. Neuro Oncol. 2013 Jul;15(7):936-44. PubMed PMID: 23645534; PubMed Central PMCID: PMC3688017.
c. Schmainda KM, Zhang Z, Prah M, Snyder BS, Gilbert MR, Sorensen AG, **Barboriak DP**, Boxerman JL. Dynamic susceptibility contrast MRI measures of relative cerebral blood volume as a prognostic marker for overall survival in recurrent glioblastoma: results from the ACRIN 6677/RTOG 0625 multicenter trial. Neuro Oncol. 2015 Aug;17(8):1148-56., PMCID: PMC4490871
d. **Barboriak D**, Steingrimsson J, Gatsonis C, Schiff D, Kleinberg L. CLRM-07. INCREASING EFFICIENCY IN EARLY PHASE MULTICENTER IMAGING BIOMARKER TRIALS: EMERGING STRATEGIES FROM THE GABLE (GLIOBLASTOMA ACCELERATED BIOMARKER LEARNING ENVIRONMENT) TRIAL. Neurooncol Adv. 2021 Sep 21;3(Suppl 4):iv2. PMCID: PMC8453792.

2. Automation of Quantitative Image Analysis Workflows.

The lack of standardized and robust image analysis methods is generally recognized as an important barrier to the clinical translation of many quantitative imaging techniques, and adds to the uncertainty about the interpretation of the results of analyses. I have been heavily involved in identifying 1) *how* to automate workflows, including how to use DICOM header information to tailor image analysis pipelines (a) and 2) *what* to automate – which factors contribute to the variability of quantitative biomarkers.

My work has shown that variability of reader segmentations of tumor-related enhancement is a major contributor to the variability of advanced perfusion imaging biomarkers in multicenter trials (b), and suggests that use of automated segmentation techniques (c), particularly those developed using artificial intelligence/machine learning approaches, could be a key factor in reducing overall variability. The segmentations of tumor-related enhancement are themselves crucial for measurements of tumor response in treatment trials, and for localizing areas of increasing tumor for directed therapies such as surgery, radiation therapy or tumor-treating fields. For this reason, I have developed expertise in the evaluation of automated segmentation algorithms. Importantly, a recent study from my lab show that use of scans obtained at short time intervals have definite shortcomings in the evaluations of reproducibility of tumor-related enhancement segmentations (d) that will require supplementary approaches to overcome.

a. **Barboriak DP**, Padua AO, York GE, Macfall JR. Creation of DICOM--aware applications using ImageJ. J Digit Imaging. 2005 Jun;18(2):91-9. doi: 10.1007/s10278-004-1879-4. PMID: 15827831; PMCID: PMC3046706.
b. **Barboriak DP**, Zhang Z, Desai P, Snyder BS, Safriel Y, McKinstry RC, Bokstein F, Sorensen G, Gilbert MR, Boxerman JL. Interreader Variability of Dynamic Contrast-enhanced MRI of Recurrent Glioblastoma: The Multicenter ACRIN 6677/RTOG 0625 Study. Radiology. 2019 Feb;290(2):467-476. doi: 10.1148/radiol.2019181296. Epub 2018 Nov 27. PMID: 30480488; PMCID: PMC6358054.
c. Schmainda KM, Prah MA, Zhang Z, Snyder BS, Rand SD, Jensen TR, **Barboriak DP**, Boxerman JL. Quantitative Delta T1 (dT1) as a Replacement for Adjudicated Central Reader Analysis of Contrast-Enhancing Tumor Burden: A Subanalysis of the American College of Radiology Imaging Network 6677/Radiation Therapy Oncology Group 0625 Multicenter Brain Tumor Trial. AJNR Am J Neuroradiol. 2019 Jul;40(7):1132-1139. doi: 10.3174/ajnr.A6110. Epub 2019 Jun 27. PMID: 31248863; PMCID: PMC6620020.
d. Abu Khalaf N, Desjardins A, Vredenburgh JJ, **Barboriak DP**. Repeatability of Automated Image Segmentation with BraTumIA in Patients with Recurrent Glioblastoma. AJNR Am J Neuroradiol. 2021 Mar 18. doi: 10.3174/ajnr.A7071. Epub ahead of print. PMID: 33737270.

Complete List of Published Work in MyBibliography:

https://www.ncbi.nlm.nih.gov/myncbi/daniel.barboriak.1/bibliography/public/