ARIC Manuscript Proposal # 1354

PC Reviewed: <u>3/18/08</u>   **Status:** <u>A</u>   **Priority:** <u>1</u>
SC Reviewed: _____   **Status:** _____   **Priority:** ____

1.a. Full Title: Is flow in the common carotid artery fully-developed?

  b. Abbreviated Title (Length 26 characters): **Carotid velocity profiles**

2. Writing Group:
  Writing group members: Matthew D. Ford, Joyce Xie, Bruce A. Wasserman, David
  A. Steinman; others welcome)

I, the first author, confirm that all the coauthors have given their approval for this
manuscript proposal. _MDF_ **[please confirm with your initials electronically or in
writing]**

  First author: **Matthew D. Ford**
  Address: University of Toronto
         5 King's College Road
         Toronto ON, Canada M5S 3G8
         Phone: 416-978-7773   Fax: 416-978-7753
         E-mail: mford@mie.utoronto.ca

Corresponding/senior author (must be an ARIC investigator for the proposal but can be
different in the published paper; correspondence will be sent to both the first author & the
corresponding author): Bruce A. Wasserman
  Address: Johns Hopkins School of Medicine
         Phipps B-100, 600 North Wolfe St.
         Baltimore MD 21287-2182
         Phone: 410-283-6073   Fax: 410-614-9200
         E-mail: bwasser@jhmi.edu

3. Timeline:
  Mar-April 2008: Data analysis and manuscript preparation

4. Rationale:
  Flow in the common carotid artery (CCA) is usually assumed to be fully-developed
  (i.e., parabolic velocity profile) to justify the clinical measurement of flow rate or
  wall shear stress from limited velocity data (e.g., spectral peak velocities from
  Doppler US). Surprisingly, this assumption has never been directly tested.

5. Main Hypothesis/Study Questions:

The specific aim of this study is to determine whether velocity profiles in the human CCA indeed conform to the assumed parabolic shape

6. Design and analysis (study design, inclusion/exclusion, outcome and other variables of interest with specific reference to the time of their collection, summary of data analysis, and any anticipated methodologic limitations or challenges if present).

Inclusion criteria: N=45 participants for whom replicate MRI studies were acquired at Wake Forest (N=8), Jackson (N=18), and Hagerstown (N=19) sites, as part of the CARMRI ARIC substudy. (Replicate data from the N=15 Minneapolis subjects excluded due to difficulties obtaining quantitative velocity data from Siemens MRI data acquired there.)

Study design: Lumen contours were segmented semi-automatically from cine phase contrast images of the CCA acquired at 32 phases of the cardiac cycle, as part of ARIC ancillary study 2006,02C. Based on that data, computed-assisted, Fourier-based shape classifiers were used to categorize velocity profiles as (i) axisymmetric (fully-developed); (ii) skewed, as would arise from a mildly-curved CCA; and (iii) crescent-shaped, as would arise from a strongly-curved CCA.

Data Analysis: Primary outcome variable is the shape of the cycle-averaged velocity profile, reported as the number of cases falling within each of the three categories. For non-axisymmetric velocity profiles, a secondary outcome variable is orientation of the skewing relative to the subject's anterior-posterior axis. Sub-analysis will be performed to determine whether profile shape is significantly associated with normal vs. accelerated aging. Replicates will be used to test whether the profile shape and orientation is stable within individuals. **Coordinating center required to perform this straightforward data analysis, unless one of study authors is unblinded to replicate pair IDs.**

Limitations: CARMRI includes only subjects aged 60-80, not necessarily representative of the typical Doppler clinic population. Preliminary analysis suggests that fully-developed flow is the *exception* rather than the rule. The proposed paper will be used to support an anticipated NIBIB R03 to include wider range of CARMRI and VALIDATE cases as part of a broader characterization of velocity profile and flow rate waveform characteristics (ARIC ancillary study 2006.13).

7.a. Will the data be used for non-CVD analysis in this manuscript? _____ Yes __X__ No

b. If Yes, is the author aware that the file ICTDER03 must be used to exclude persons with a value RES_OTH = "CVD Research" for non-DNA analysis, and for DNA analysis RES_DNA = "CVD Research" would be used? _____ Yes _____ No
(This file ICTDER03 has been distributed to ARIC PIs, and contains the responses to consent updates related to stored sample use for research.)

8.a. Will the DNA data be used in this manuscript?   ____ Yes   __X__ No

8.b. If yes, is the author aware that either DNA data distributed by the Coordinating Center must be used, or the file ICTDER03 must be used to exclude those with value RES_DNA = "No use/storage DNA"?
                    ____ Yes   ____ No

9.The lead author of this manuscript proposal has reviewed the list of existing ARIC Study manuscript proposals and has found no overlap between this proposal and previously approved manuscript proposals either published or still in active status. ARIC Investigators have access to the publications lists under the Study Members Area of the web site at: http://www.cscc.unc.edu/ARIC/search.php

    ___X__ Yes   _____ No

10. What are the most related manuscript proposals in ARIC (authors are encouraged to contact lead authors of these proposals for comments on the new proposal or   collaboration)?

11. a. Is this manuscript proposal associated with any ARIC ancillary studies or use any ancillary study data?   __X_ Yes   ____ No

11.b. If yes, is the proposal
        _X_   A. primarily the result of an ancillary study (list number: *2006.02C)
        ___   B. primarily based on ARIC data with ancillary data playing a minor role (usually control variables; list number(s)* _____ _____
        _____)

*ancillary studies are listed by number at http://www.cscc.unc.edu/aric/forms/

12. Manuscript preparation is expected to be completed in one to three years. If a manuscript is not submitted for ARIC review at the end of the 3-years from the date of the approval, the manuscript proposal will expire.