

Letters to the Editor

Body Size and the Early Mortality Gender Gap in Coronary Artery Bypass Grafting Surgery

Humphries et al. (1) investigated gender differences in 30-day mortality after isolated coronary artery bypass grafting (CABG) for the entire province of British Columbia from 1991 to 2004. The authors report a substantial trend for improved early CABG mortality in women over this 14-year period. Yet there remains a significant 42% worse 30-day mortality in women even after adjustment for differences in age, comorbid conditions, and surgical factors. Lastly, they report that this gender gap in early CABG outcomes is decreased and is no longer statistically significant (odds ratio 1.26, 95% confidence interval 0.96 to 1.64) when their data is adjusted to body surface area (BSA). The authors explained the latter by a presumed association between lower BSA and smaller coronary vessel size.

We concur with the authors that patients with lower BSA are more likely to have smaller coronary targets that are more difficult to revascularize with potential adverse implications on outcomes. This, however, ignores other important factors that are associated with body size and are especially true in case of CABG with cardiopulmonary bypass such as in their series (97% on-pump). A strong association between small body size—disproportionately represented by women—and greater on-pump hemodilution and more frequent administration of packed red blood cell (RBC) units is well established (2,3). Worse early CABG outcomes have been associated with both lower on-pump hematocrits (2–4) and RBC transfusions (5,6). We contend that the authors' reported 30-day mortality odds ratio of 1.26 in women compared with men would be further reduced if their multivariate adjustment included hemodilutional anemia and transfusion data. This perspective is important, because in contrast to coronary vessel size, which is a fixed patient characteristic, both of these size-related risk factors are potentially modifiable. Specifically, hemodilutional anemia and related use of blood products may be mitigated through specific practices such as: 1) avoidance of cardiopulmonary bypass (off-pump surgery); 2) use of miniaturized bypass circuits combined with retrograde autologous priming; and/or 3) implementation of conservative transfusion policies.

***Robert H. Habib, PhD**
Anoar Zacharias, MD

*Cardiopulmonary Research
St. Vincent Mercy Medical Center
2213 Cherry Street, ACC Bldg, Suite 309
Toledo, Ohio 43608
E-mail: robert_habib@mhsnr.org

REFERENCES

1. Humphries KH, Gao M, Pu A, Lichtenstein S, Thompson CR. Significant improvement in short-term mortality in women undergoing coronary artery bypass surgery (1991 to 2004). *J Am Coll Cardiol* 2007;49:1552–8.
2. DeFoe GR, Ross CS, Olmstead EM, et al., Northern New England Cardiovascular Disease Study Group. Lowest hematocrit on bypass and adverse outcomes associated with coronary artery bypass grafting. *Ann Thorac Surg* 2001;71:769–76.
3. Habib RH, Zacharias A, Schwann TA, Riordan CJ, Durham SJ, Shah A. Adverse effects of low hematocrit during cardiopulmonary bypass in the adult: should current practice be changed? *J Thorac Cardiovasc Surg* 2003;125:1438–50.
4. Koch CG, Li L, Duncan AI, et al. Morbidity and mortality risk associated with red blood cell and blood-component transfusion in isolated coronary artery bypass grafting. *Crit Care Med* 2006;34:1608–16.
5. Engoren M, Habib RH, Zacharias A, et al. Effect of blood transfusion on long-term survival after cardiac surgery. *Ann Thorac Surg* 2002;74:1180–6.
6. Habib RH, Zacharias A, Schwann TA, Riordan CJ, Durham SJ, Shah A. Effects of obesity and small body size on operative and long term outcomes of coronary artery bypass surgery: a propensity matched analysis. *Ann Thorac Surg* 2005;79:1976–86.

Reply

We thank Drs. Habib and Zacharias for their thoughtful comments on our manuscript (1). First it is important to clarify that the significant 42% higher 30-day mortality in women reported in our study refers to the *overall* 14-year time frame of the study and does not imply that a 42% difference still persists at the end of our study period. Quite the contrary, the gap narrowed significantly.

We certainly agree with the authors that coronary vessel size is not the only important factor associated with body size. Specifically, the adverse effects of greater on-pump hemodilution and more frequent administration of packed red blood cells in patients with small body size suggests that women would be differentially affected. These aspects would be interesting to evaluate, especially because they are not intrinsic patient characteristics but potentially modifiable processes of care. Unfortunately, our database did not reliably capture this information.

Nevertheless, it is important to point out that even if we could undertake the suggested analysis, any attenuation in the gender difference that might result from adjustment for red blood cell transfusions and on-pump hematocrit would be unlikely to explain the significant decline in female 30-day mortality over the last 14 years. To attribute the observed decline in mortality to these factors would necessitate a very large decrease in the prevalence of hemodilutional anemia and/or use of blood products differentially in women compared with men. Alternatively, because these characteristics are associated with body size, we would have had to observe a very sharp decline in the proportion of women versus men with small body size. As shown in Table 3 of our manuscript, the proportion of women with small body size changed very little in our dataset over the last 14 years.

In light of the evidence that hemodilution (2,3) and frequent transfusions are associated with adverse outcomes (4,5), changes in

doi:10.1016/j.jacc.2007.05.034

practice, as suggested by the Drs. Habib and Zacharias, would be expected to be of benefit to both women and men.

***Karin H. Humphries, MBA, DSc**
Min Gao, PhD
Aihu Pu, MSc
Samuel V. Lichtenstein, MD, PhD
Christopher R. Thompson, MD

*Division of Cardiology
St. Paul's Hospital
620B-1081 Burrard Street
Vancouver, British Columbia V6Z 1Y6
Canada
E-mail: khumphries@providencehealth.bc.ca

doi:10.1016/j.jacc.2007.05.036

REFERENCES

1. Humphries KH, Gao M, Pu A, et al. Significant improvement in short-term mortality in women undergoing coronary artery bypass surgery (1991 to 2004). *J Am Coll Cardiol* 2007;49:1552-8.
2. DeFoe GR, Ross CS, Olmstead EM, et al., Northern New England Cardiovascular Disease Study Group. Lowest hematocrit on bypass and adverse outcomes associated with coronary artery bypass grafting. *Ann Thorac Surg* 2001;71:769-76.
3. Habib RH, Zacharias A, Schwann TA, et al. Adverse effects of low hematocrit during cardiopulmonary bypass in the adult: should current practice be changed? *J Thorac Cardiovasc Surg* 2003;125:1438-50.
4. Engoren MC, Habib RH, Zacharias A, et al. Effect of blood transfusion on long-term survival after cardiac operation. *Ann Thorac Surg* 2002;74:1180-6.
5. Habib RH, Zacharias A, Schwann TA, et al. Role of hemodilutional anemia and transfusion during cardiopulmonary bypass in renal injury after coronary revascularization: implications on operative outcome. *Crit Care Med* 2005;33:1749-56.