

## Response to Letter Regarding Article, “Association Between Surgical Indications, Operative Risk, and Clinical Outcome in Infective Endocarditis: A Prospective Study From the International Collaboration on Endocarditis”

We appreciate the thoughtful comments of Drs Almonedro-Delia, Galvez-Acebal, and Rodriguez-Bano regarding our recent publication, “Association Between Surgical Indications, Operative Risk, and Clinical Outcome in Infective Endocarditis: a Prospective Study From the International Collaboration on Endocarditis.”<sup>1</sup> These authors raise important issues for evaluating the impact of surgery on patient outcomes, particularly survival. We strongly agree that treatment selection bias and survivor bias are major issues when evaluating the impact of surgery on mortality and that the use of appropriate statistical methodologies is necessary to quantify an unbiased and causal association of the effect of surgical treatment on outcome. In our previous studies on the impact of surgery on mortality, we have used such methods, including propensity scores,<sup>2</sup> to account for selection bias and Cox proportional hazards models with surgery entered as a time-dependent covariate<sup>3,4</sup> for survivor bias adjustment. However, the objective of the current study was to evaluate the differences in clinical characteristics comparing patients treated with and without cardiac surgery for infective endocarditis, and to evaluate the relationship between surgical indications, operative risk (by using the Society of Thoracic Surgeons operative risk score), and outcome. Our results emphasize the relevance of specific surgical indications in treatment decisions in infective endocarditis, and the relationship between the Society of Thoracic Surgeons operative risk score and outcome, as well. The purpose of our study was not to determine the prognostic influence of surgery in comparison with medical therapy alone in infective endocarditis.

### Disclosures

Dr Miro has received consulting honoraria or research grants from Abbvie, Boehringer-Ingelheim, Bristol-Meyers Squibb, Cubist, Novartis, GlaxoSmithKline, Glead Sciences, Pfizer, Roche, Theravance, and ViiV. Dr Chu has received a research grant from Merck and royalties from UpToDate. The other authors report no conflicts.

**Vivian H. Chu, MD, MHS**  
**Lawrence P. Park, PhD**

*Duke University Medical Center  
Durham, NC*

**Eugene Athan, MD**

*Barwon Health and Deakin University  
Geelong, Australia*

**Francois Delahaye, MD**

*Hospital Louis Pradel  
Lyon-Bron, France*

**Tomas Freiberger, MD, PhD**

*Centre for Cardiovascular Surgery and Transplantation, Brno  
Central European Institute of Technology  
Masaryk University  
Brno, Czech Republic*

**Cristiane Lamas, MD, MRCP, PhD**

*Instituto Nacional de Cardiologia, and Unigranrio  
Rio de Janeiro, Brazil*

**Jose M. Miro, MD, PhD**

*Infectious Diseases Service  
Hospital Clinic – IDIBAPS*

*University of Barcelona  
Barcelona, Spain*

**Daniel W. Mudrick, MD**

*OhioHealth Heart and Vascular Physicians  
Columbus, OH*

**Jacob Strahilevitz, MD**

*Hadassah-Hebrew University Medical Center  
Jerusalem, Israel*

**Christophe Tribouilloy, MD, PhD**

*University Hospital  
Amiens, France  
INSERM U-1088  
University of Picardie  
Amiens, France*

**Emanuele Durante-Mangoni, MD, PhD**

*Internal Medicine  
University of Naples SUN  
Monaldi Hospital  
Naples, Italy*

**Juan M. Pericas, MD**

*Infectious Diseases Service  
Hospital Clinic – IDIBAPS  
University of Barcelona  
Barcelona, Spain*

**Nuria Fernández-Hidalgo, MD, PhD**

*Hospital Universitari Vall d'Hebron  
Universitat Autònoma de Barcelona  
Barcelona, Spain*

**Francisco Nacinovich, MD**

*Instituto Cardiovascular de Buenos Aires  
Buenos Aires, Argentina*

**Hussien Rizk, MD**

*Cairo University Hospital  
Cairo, Egypt*

**Vladimir Krajinovic, MD, PhD**

*University Hospital for Infectious Diseases  
Zagreb, Croatia*

**Efthymia Giannitsioti, MD**

*Attikon University General Hospital  
Athens, Greece*

**John P. Hurley, MD, FRCSI**

**Margaret M. Hannan, MD**

*Mater Misericordiae University Hospital  
Dublin, Ireland*

**Andrew Wang, MD**

*Duke University Medical Center  
Durham, NC*

**for the ICE Investigators**

### References

1. Chu VH, Park LP, Athan E, Delahaye F, Freiberger T, Lamas C, Miro JM, Mudrick DW, Strahilevitz J, Tribouilloy C, Durante-Mangoni E, Pericas JM, Fernández-Hidalgo N, Nacinovich F, Rizk H, Krajinovic V, Giannitsioti E, Hurley JP, Hannan MM, Wang A; International Collaboration on Endocarditis (ICE) Investigators\*. Association between surgical indications, operative risk, and clinical outcome in infective

- endocarditis: a prospective study from the International Collaboration on Endocarditis. *Circulation*. 2015;131:131–140. doi: 10.1161/CIRCULATIONAHA.114.012461.
- Lalani T, Cabell CH, Benjamin DK, Lasca O, Naber C, Fowler VG Jr, Corey GR, Chu VH, Fenely M, Pachirat O, Tan RS, Watkin R, Ionac A, Moreno A, Mestres CA, Casabé J, Chipigina N, Eisen DP, Spelman D, Delahaye F, Peterson G, Olaison L, Wang A; International Collaboration on Endocarditis-Prospective Cohort Study (ICE-PCS) Investigators. Analysis of the impact of early surgery on in-hospital mortality of native valve endocarditis: use of propensity score and instrumental variable methods to adjust for treatment-selection bias. *Circulation*. 2010;121:1005–1013. doi: 10.1161/CIRCULATIONAHA.109.864488.
  - Lalani T, Chu VH, Park LP, Cecchi E, Corey GR, Durante-Mangoni E, Fowler VG Jr, Gordon D, Grossi P, Hannan M, Hoen B, Muñoz P, Rizk H, Kanj SS, Selton-Suty C, Sexton DJ, Spelman D, Ravasio V, Tripodi MF, Wang A; International Collaboration on Endocarditis-Prospective Cohort Study Investigators. In-hospital and 1-year mortality in patients undergoing early surgery for prosthetic valve endocarditis. *JAMA Intern Med*. 2013;173:1495–1504. doi: 10.1001/jamainternmed.2013.8203.
  - Chirouze C, Alla F, Fowler VG Jr, Sexton DJ, Corey GR, Chu VH, Wang A, Erpelding ML, Durante-Mangoni E, Fernández-Hidalgo N, Giannitsioti E, Hannan MM, Lejko-Zupanc T, Miró JM, Muñoz P, Murdoch DR, Tattevin P, Tribouilloy C, Hoen B; ICE Prospective Investigators. Impact of early valve surgery on outcome of Staphylococcus aureus prosthetic valve infective endocarditis: analysis in the International Collaboration of Endocarditis-Prospective Cohort Study. *Clin Infect Dis*. 2015;60:741–749. doi: 10.1093/cid/ciu871.