the intensive care unit with a high incidence of delayed sternal closure. Open sternums do translate into a high risk of infection in tropical countries² and may adversely affect the outcome. Also with a single-stage strategy, extracorporeal membrane oxygenation support may not always be available if there is difficulty weaning these patients from CPB, particularly after an extensive 2-stage procedure in a neonate. Under these circumstances, if the anatomy of the CoA is suitable for repair and there is no need for arch repair, a 2-stage approach can often be justified, particularly in the neonatal age group in whom the risk of CPB and total circulatory arrest related complications is higher. These patients can have the VSD closure in a safe manner at a later stage, which is also technically simpler in an older patient.

In patients beyond the neonatal period with uncomplicated CoA, we prefer the single-stage approach described by Kanter and colleagues,³ in which the CoA is first repaired via a posterolateral thoracotomy, the patient is turned supine, and the VSD is closed using standard CPB. The advantages of this approach are its simplicity, better CoA management (debatable), less CPB times, and avoidance of circulatory arrest. However, this strategy is not applicable to patients with arch hypoplasia and has the disadvantage of 2 incisions.

In most of the public hospitals in India and other developing countries, an initial repair of the CoA costs approximately \$500 and a subsequent second stage can be accomplished at less than \$1500, but if we were to adopt a 1-stage approach, we may incur a substantial increase in costs because of a higher morbidity and longer intensive care unit stay. Despite the claimed advantages of a single-stage approach, we continue to advocate the 2-stage approach in developing countries, particularly in those centers where "proficiency" has not been achieved in managing these critically ill small neo-

nates. The authors are to be congratulated on successfully achieving this.

Sachin Talwar, MCh
Shiv Kumar Choudhary, MCh
Balram Airan, MCh
Cardiothoracic Center
All India Institute of Medical Sciences
New Delhi, India

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Reply to the Editor:

As Talwar and colleagues state in their Letter to the Editor, we acknowledged the obvious and unavoidable era bias in our article. The 3 patients who underwent repair of coarctation (CoA) of the aorta *alone*, using a median sternotomy incision with cardiopulmonary bypass, had significant proximal aortic arch hypoplasia that precluded satisfactory repair through a left posterolateral thoracotomy incision. In the era during which those patients presented, we were not performing single-stage repair of CoA with ventricular septal defect (VSD).

We agree that the socioeconomic context in which the patient with CoA-VSD presents should be considered when choosing the surgical strategy, namely, single- versus 2-stage repair. Similarly, institutional resources and surgeon-specific variables should also be factored into this decision. We have documented, in our own institutional experience, that the increased need for delayed sternal closure has now been neutralized¹ and that the risk of mediastinitis with delayed sternal closure,

when used, is minimal,² but the same may not be true in other centers.

Nonetheless, the advantages of single-stage repair that we have clearly documented, such as earlier age at complete repair, as well as the hypothetical advantages that we have postulated, such as better neurodevelopmental outcomes related to earlier complete repair, may, in the end, transcend the economic advantages of 2-stage repair. Therefore, the single-stage repair of CoA-VSD could, in the future, become a goal worth pursuing in all centers regardless of socioeconomic barriers. With further research on neurodevelopmental outcomes, the advantages of this technique may become important enough to serve as a stimulus for the development of resources to accommodate its successful and improved implementation.

Henry L. Walters, III, MD
Department of Cardiovascular Surgery
Children's Hospital of Michigan
Detroit Medical Center
Wayne State University School of
Medicine
Detroit, Mich

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SOLID AND GASEOUS CEREBRAL MICROEMBOLIZATION AFTER BIOLOGIC AND MECHANICAL AORTIC VALVE REPLACEMENT: INVESTIGATION WITH MULTIRANGE AND MULTIFREQUENCY TRANSCRANIAL DOPPLER ULTRASOUND

To the Editor:

We read with interest the recent article by Guerrieri Wolf and colleagues¹