included in the investigation. For example, in the study of Fakler and associates,[1] new formulas with new coefficients could be calculated using 70 patients included in their investigation and could be validated against the remaining 73 patients for comparing measured and estimated VO_2.

Fakler and associates[1] reported that the routine use of assumed VO_2 when calculating cardiac output with the direct Fick principle might frequently result in large errors in the estimation of cardiac output and dependent parameters. To obtain reliable cardiac output values by the direct Fick equation, VO_2 should be measured as concluded by Fakler and associates[1] or estimated with a new formula calculated using the population included in the study.

Habib Benallal
Experimental Toxicology
Department-Modeling Group
INERIS (National Institute for industrial Environment and RISks)
60550 Verneuil en Halatte, France

References

1. Fakler U, Pauli C, Henning M, Sebening W, Hess J. Assumed oxygen consumption frequently results in large errors in the determination of cardiac output. *J Thorac Cardiovasc Surg*. 2005;130:272-6.
2. Krovetz LJ, Goldbloom S. Normal standards for cardiovascular data. I. Examination of the validity of cardiac index. *Johns Hopkins Med J*. 1972;130:174-86.
3. LaFarge CG, Miettinen OS. The estimation of oxygen consumption. *Cardiovas. Res*. 1970;4: 23-30.
4. Laitinen PO, Räsänen J. Measured versus predicted oxygen consumption in children with congenital heart disease. *Heart*. 1998; 80:601-5.

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Reply to the Editor:

We thank Benallal for his comments on our article and appreciate his remarks.

Our study was specifically designed to assess the importance of measured oxygen consumption (VO_2) in the preoperative diagnostic hemodynamic evaluation during cardiac catheterization and to assess whether published formulas allow a reliable calculation of VO_2. We did not intend to develop a new formula to assume VO_2.

Our results emphasize that both the Krovetz-Goldbloom formula,[1] which had been used to this point in our institution, and the more commonly used formula published by LaFarge and Miettinen[2] are not feasible in all patients to assume VO_2 and thereby calculate cardiac output by the Fick principle.

Li and colleagues[3] presented the important conclusion that other predictive equations published by Lundell and associates,[4] Wessel and colleagues,[5] and Lindahl[6] also do not accurately estimate VO_2. All these formulas were developed to offer a suitable and reliable method to assume VO_2 in order to simplify the calculation of hemodynamic parameters. However, these formulas cannot be used in all patients and settings.

As Benallal pointed out, these formulas include coefficients depending on characteristics of the population investigated in these studies. The difference between measured and assumed VO_2 might be due to a population difference. In addition, it is also influenced essentially by other conditions such as the mode of general anesthesia and relaxation used in different institutions.

It is difficult to identify feasible coefficients to develop a formula fitting to all conditions of hemodynamic evaluation during cardiac catheterization.

Moreover, we are convinced that our population of 143 patients is too small to identify and validate suitable coefficients for a new formula. LaFarge and Miettinen derived their most commonly used formulas from a multivariate analysis of covariance applied to data on a series of 879 patients.

U. Fakler, MD
J. Hess, MD
German Heart Center
Department of Pediatric Cardiology and Congenital Heart Disease
Technische Universität München
Munich, Germany

References

1. Krovetz LJ, Goldbloom S. Normal standards for cardiovascular data. I. Examination of the validity of cardiac index. *Johns Hopkins Med J*. 1972;130:174-86.
2. LaFarge CG, Miettinen OS. The estimation of oxygen consumption. *Cardiovasc Res*. 1970;4: 23-30.
3. Li J, Bush A, Schulze-Neick I, Penny DJ, Redington AN, Shekerdemian LS. Measured versus estimated oxygen consumption in ventilated patients with congenital heart disease: the validity of predictive equations. *Crit Care Med*. 2003;31:1235-40.
4. Lundell BPW, Casas ML, Wallgren CG. Oxygen consumption in infants and children during heart catheterization. *Pediatr Cardiol*. 1996;17:207-13.
5. Wessel HU, Rorem D, Muster AJ, Acevedo RE, Paul MH. Continuous determination of oxygen uptake in sedated infants and children during cardiac catheterization. *Am J Cardiol* 1969;24:376-85.
6. Lindahl SGE. Oxygen consumption and carbon dioxide elimination in infants and children during anaesthesia and surgery. *Br J Anaesth*. 1989;62:70-6.

doi:10.1016/j.jtcvs.2005.11.005

Linking gene expression, nuclear factor kappa B, remote ischemic preconditioning, and transplantation: A quest for an elusive Holy Grail or a road to an amazing discovery?

To the Editor:

We read with interest the recent paper of Ishiyama and colleagues[1] reporting that inhibition of nuclear factor kappa B (NF-κB) by IκB supressor gene transfer ameliorated ischemia-reperfusion (IR) injury after experimental lung transplantation. A few comments seem appropriate.

Is activation of NF-κB before transplantation destructive or protective? Two murine studies provided seemingly contradictory results. In the study of Ishiyama and colleagues,[1] inhibition of NF-κB rendered protection against the IR injury, yet in another study[2] a targeted deletion of the p105 subunit of the NF-κB abolished the protective effect of the remote ischemic preconditioning (rIPC), a novel clinically applicable mode of protection against IR injury, whereby the organs can be protected by a brief ischemia applied *remotely* (eg, limb ischemia). Gene expression appears to play an important role in rIPC. In our own studies, the rIPC stimulus modified NF-κB regulated gene expression in leukocytes[3] and the target organ,[4] and when the rIPC was applied to the recipient in porcine model it rendered myocardial protection *after* the orthotopic heart transplantation.[5]

It is widely known that the transcription factor NF-κB can be activated by a variety of stimuli, for example, tumor necrosis factor (TNF)-α, bacterial lipopolysaccharide (LPS), and heat shock protein (HSP). Stimulation of the cell may lead to phosphorylation of IκB and translocation of NF-κB into the nucleus, resulting in gene expression, including those genes responsible for exocytosis of adhesive molecules and cytokine production in leukocytes, but also for production of protective substances eg, manganese superoxide dismutase (Mn-SOD) and inducible nitric oxide synthase