To the Editor—It was with great interest that we read the article by Cravens et al.1 on the incidence of propofol infusion syndrome. This is obviously an important question with significant clinical relevance. However, with all of the inherent limitations of a retrospective study as recognized by the authors, we find the interpretation and conclusion of the authors (‘this study provides evidence that even in a non-critically ill population, prolonged high-dose propofol infusion is associated with otherwise unexplained metabolic acidosis in a significant number of patients’) to be inconsistent with the limited data presented.

To begin, their definition of metabolic acidosis is problematic, because it merely represents the upper limit of the reference range for base excess. We understand that the definition of metabolic acidosis might be tricky, particularly if bicarbonate and chloride are unknown. However, the definition should meet the generally accepted criterion, and base excess should be lower than, and not equal to, $−2 \text{ mEq/L}$. As it were, 2 of 15 patients with ‘propofol infusion syndrome’ really had a normal base excess ($=−2$), and 4 patients had a base excess of $−2$, which is nearly normal (fig. 1 in the article).

Of the cohort of 301 patients, only 55 patients had arterial blood gases drawn at various stages because of concern with their respiratory status. The authors argue that this may underestimate, and not overestimate, the incidence of ‘propofol infusion syndrome.’ We respectfully disagree. A more appropriate interpretation is that the incidence remains unknown, because the factors that predispose these individuals to respiratory depression may also have resulted in the metabolic acidosis. Without a control group, the influence of this built-in bias simply cannot be assessed.

Another problem relates to the variability of blood sampling timing and the lack of baseline data. The authors’ figure 1 shows that one patient had base excess of $−6$ at a very low rate of propofol infusion. Without baseline blood gases and knowledge of the total dose of propofol infused, the authors cannot consider this patient to have propofol infusion syndrome. Moreover, because in all patients the timing of blood sampling is not reported and baseline blood gases are not available, the data in figure 1 are essentially uninterpretable, and one wonders why the plot was made at all. Similarly, the data displayed in their table 2 regarding duration of propofol infusion is not meaningful because the crucial time is the duration of infusion (and amount of propofol given) at the time of blood gas sampling, not the total duration of the infusion for the procedure. About the only fact we can be certain of is that the authors overestimate the duration of propofol infusion before the development of this mild metabolic acidosis, which may not have any relation to the propofol infusion.

Propofol infusion syndrome is diagnosed in cases of unexplained severe metabolic, usually lactic, acidosis and is associated with high-dose3–5 or long-duration propofol infusion,6,7 usually both.8,9 We are surprised that Cravens et al. titled their work as ‘Incidence of Propofol Infusion Syndrome during . . . ’, because the study did not include any patient who developed frank propofol infusion syndrome. Finally, to conclude that ‘this study provides evidence that even in a non-critically ill population, prolonged high-dose propofol infusion is associated with otherwise unexplained metabolic acidosis in a significant number of patients’ is a stretch of one’s imagination. Not only was the duration of propofol infusion before the development of metabolic acidosis unknown, the dose of propofol given was a sedative dose and could hardly qualify as high dose by any clinical standard.

To be fair, as the authors indicated, it is difficult to draw definitive conclusions from a retrospective study. However, they should be valid if not definitive. We performed a similar retrospective chart review, comparing lactate, bicarbonate, chloride, arterial carbon dioxide tension, pH, and other parameters in patients receiving high-dose propofol anesthesia ($n = 50$) and volatile anesthesia ($n = 100$) over time in long-duration spine surgeries, and we observed that lactate levels are significantly lower during propofol infusion anesthesia.$^{10}$ The manuscript is currently in preparation. We do fully agree with Cravens et al. on one aspect: A larger prospective study is warranted to look for early signs of propofol infusion syndrome and its incidence.

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(Accepted for publication September 26, 2007.)
To the Editor.—We read with interest the retrospective study from Cravens et al.1 about propofol infusion syndrome. The authors reported a high incidence of slight metabolic acidosis during prolonged propofol infusion in patients who received a total dose of approximately 20 mg/kg.

The main cause of propofol infusion syndrome would be cumulative high-dose propofol, whereas low doses would be safe.2,3 However, there is a lack of studies looking for acidosis related to propofol infusion, and prospective studies are needed to confirm the relation between high-dose propofol and acidosis and to guarantee the safety of low-dose propofol routinely used for sedation or anesthesia. Regarding the latter, our group recently performed a prospective randomized trial in 42 patients scheduled to undergo thoracotomy to evaluate the effects of almitrine and inhaled nitric oxide on oxygenation.6 Arterial blood gases and lactic acid were determined in all patients: the former because arterial oxygen tension was the main variable, and the latter to discard lactic acidosis that could be an eventual complication of almitrine administration.7,8 All of the patients in the study received intravenous anesthesia with propofol and remifentanil.9 The research protocol and the administration of propofol were strictly standardized. In all of the patients, anesthesia was induced with 1 mg · kg−1 · h−1 propofol and maintained with 3 mg · kg−1 · h−1 propofol, so that all of the patients received an average dose of 6 mg/kg propofol.

Arterial pH and lactate concentrations did not significantly change during the study, remaining within the normal range in all patients (7.35–7.45 and 0.5–1.6 mmol/liter, respectively).6 These results suggest that our patients were not at risk of propofol infusion syndrome after receiving approximately a third of the dose administered by Cravens et al.1

In conclusion, we did not observe lactic acidosis in patients receiving low-dose propofol. These results can be useful to support the safety of short-duration, low-dose propofol, strengthening the hypothesis that acidosis after propofol infusion would be related to cumulative high doses of the drug.

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In Reply.—We appreciate the interest in our report1 by Drs. Rozet and Lam and by Dr. Gallart et al., and we welcome the opportunity to address the important issues raised in their letters. We agree with them that our results are limited by the retrospective study design and require a prospective study for confirmation, as we stated in our report.

The other concerns of Drs. Rozet and Lam seem to derive from their criticism that “the study did not include any patient who developed frank propofol infusion syndrome.” Although it is true that none of our patients exhibited severe metabolic acidosis, the purpose of our study was not to detect fulminant propofol infusion syndrome, which is rare and unlikely to be detected in the size population we studied, but to determine whether we could detect ‘initially reversible and usually benign’ metabolic acidosis in patients receiving propofol.3,1 Drs. Rozet and Lam’s assertion that propofol infusion syndrome includes only “unexplained severe metabolic, usually lactic, acidosis and is associated with high-dose or long-duration propofol infusion, usually both,” implies that the mild syndrome either never occurs or never progresses to become severe and clinically evident. These assertions are incorrect (see references 12, 14–17, and 19 and the associated discussion in our article3) and highlight the need to address the question we posed in our study.

As Drs. Rozet and Lam suggest, defining metabolic acidosis for our study was challenging. They suggest that a definition of base excess (BE) of −3 mEq/l or less would be more appropriate than BE of −2 or less, which we chose, to ‘meet the generally accepted criterion’ given in their reference 2. However, that reference and others we are aware of refer to stratifying critically ill intensive care unit patients, with the acidic population in their reference 2 having a mortality of 45%.2 In contrast, we were trying to detect early metabolic acidosis in a relatively healthy population where no mortality was expected. As we noted in our report, ‘in three well-documented cases of the syndrome, the initial negative BE was −2 to −3,’1 so we prospectively selected BE of −2 or less before data abstraction. Furthermore, it is clear from inspecting our data (table 1 and fig. 1) that excluding the few patients with maximal negative BE of −2 would cause only minor changes in the incidence of metabolic acidosis in our study population and would not change the statistical comparison with our comparator group.

Our original submission did contain data on time and propofol dose for each arterial blood gas sampling in all patients who had multiple arterial blood gases drawn. This was deleted in the interest of shortening the article, but did not appreciably affect our analysis.

We look forward to publication of the details of the retrospective study of Drs. Rozet and Lam. We congratulate them on the collection of more detailed parameters of acid–base status, including lactate and chloride, than were available to us in our study. It will be important for the report to include data on calculated BE as well as the other parameters listed, because it is the parameter most indicative of metabolic acidosis independent of ventilator adjustments.
We appreciate Dr. Gallart et al. making us aware of the article by their group where arterial blood gases and lactate levels were obtained during propofol anesthesia while studying almitrine and nitric oxide during one-lung ventilation. Both in terms of total dose and time administered, their patients' propofol exposure was less than a third of ours, suggesting a possible lower threshold for propofol metabolic acidosis. However, their study, although well designed for the questions it was addressing, may be limited by variables besides propofol: Almitrine is known to affect metabolic acidosis, ventilation was adjusted after institution of one-lung ventilation while BE was not reported, and cardiac index decreased and then increased significantly during the study.

It is important to elucidate the mechanism and incidence of propofol infusion syndrome to better prevent and treat it. We appreciate the interest of Drs. Rozet and Lam and Dr. Gallart et al. in addressing this area of concern.

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In summary, Dr. Struthers et al. are to be congratulated for further refining the predictive value of perioperative BNP with the role of the associated cardiac phenotype whether symptomatic or not. We anticipate that future trials in this area will be of higher quality and impact as a result.

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References


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In Reply—We thank Dr. Struthers et al. for their interest in our article and their suggestions for future research based on high preoperative levels of brain natriuretic peptide (BNP) and the specifics of underlying cardiac pathology.

We are well aware that fully phenotyping, i.e., identification of the underlying cardiac disease and targeted therapy, comprises current and future possibilities for primary and secondary prevention in the individual cardiologic patient, as recently highlighted by Drs. Struthers and Lang.

Preoperative phenotyping, however, is often limited by timely constraints due to concomitant and disabling illness that necessitates a rapid surgical intervention. Furthermore, surgical illness and the specifics of the perioperative period (obesity, immobilization, opioids, anemia, catecholamine surges, and hypercoagulability) may both obscure and aggravate the underlying cardiac disease. In addition, recent trials in patients with stable coronary artery disease demonstrated that knowledge of functional coronary artery stenoses and subsequent prophylactic revascularization did not improve cardiac outcome when compared with optimized conventional therapy.

For many years, anesthesiologists have been relying on clinical risk indices to define perioperative cardiac risk. Recently BNP, though being an “unspecific” marker of cardiac damage, outperformed risk indices and stress testing. In the future, determination of BNP might therefore complement anesthesiologic risk assessment by identifying high-risk/high-BNP patients and define the best time (perioperative, early postoperative, or after surgical rehabilitation) for further cardiac evaluation and targeted therapy. However, because of the lack of well-established cutoffs of BNP, influence of various patient-specific factors, and perioperative undulation of BNP, “high” values will have to be defined and validated in future studies in different surgical settings.

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Anesthesiology 2008; 108:333–4

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To the Editor.—The recent article by Cohen et al. uses intradiscal administration of the anti-tumor necrosis factor (TNF) biologic etanercept for the treatment of two subsets of patients with chronic disc-related pain. The rationale for the selection of an anti-TNF biologic for these patients, including the 42% of the study subjects with chronic lumbosacral radiculopathy, has a substantial scientific basis, which includes both basic science and clinical evidence that excess TNF-α is centrally involved in the pathogenesis of disc-related pain. In the case of lumbosacral radiculopathy, the anatomical site of inflammation and neuronal dysfunction is well delineated by the clinical presentation establishing dysfunction of a particular nerve root.

In addition, there is a reasonable scientific basis to study delivery of etanercept, which is anatomically targeted to the nerve root in those patients with clinically defined chronic radiculopathy. This scientific basis is supported not only by the evidence cited above implicating TNF-α in the initiation, amplification, and maintenance of disc-related pain, but also by the long history of the use of anatomically targeted delivery of corticosteroids for the treatment of sciatica. But it should be pointed out that each of these studies, and established medical practice, involves the use of perispinal extradiscal administration of antiinflammatories, rather than intradiscal administration, as used by the study authors.

It is therefore puzzling that Cohen et al. chose to include patients with lumbosacral radiculopathy in a study of minute doses of etanercept delivered into the intervertebral disc, where the anti-TNF biologic would be surrounded by a thick, fibrous capsule, the annulus fibrosus. It seems reasonable that the annulus fibrosus, in view of its structure, might impede delivery of etanercept to the nerve root, the expected primary site of TNF-α-mediated pathology. The intradiscal design of the study of Cohen et al. is all the more puzzling in view of the published work of my colleagues and me, some of which is cited in the article of Cohen et al.. The use of etanercept for disc-related pain was first described in 1999. Since that time, my colleagues and I have successfully treated a large number of patients with severe and intractable disc-related pain using perispinal extradiscal etanercept, a method designed to deliver etanercept in therapeutic concentration to the site of neuronal pathology, including the nerve root.

To the credit of the authors, they point out that the low doses of etanercept studied, ranging from 0.1 to 1.5 mg, may have contributed to the lack of therapeutic effect in their study. The intradiscal doses they used ranged from 0.4% to 6% of the extradiscal etanercept dose in our studies. Although it is certainly reasonable to be cautious in choosing the appropriate dose, selection of a subtherapeutic dose may doom a study to failure. In the case of etanercept for neuropathic pain, there is basic science evidence that high local concentrations of etanercept may be necessary for an optimal therapeutic effect, a rationale supporting targeted extradiscal etanercept. In their discussion, the authors hypothesize whether systemic delivery may be superior. One would argue, based on the above, that it was the subtherapeutic doses of etanercept selected, along with the choice of intradiscal rather than extradiscal perispinal administration, that resulted in the lack of efficacy observed.

It seems that Cohen et al. may not disagree with the above analysis, because they presently are conducting a trial of perispinal extradiscal etanercept, delivered epidurally, for treatment of sciatica at doses ranging from 2 to 6 mg. The concept of epidural etanercept for treatment of sciatica has been previously described, but we currently are uncertain whether this more invasive delivery method will be as efficacious as larger doses of etanercept injected superficial to the ligamentum flavum. We look forward to the results of this clinical trial.

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References


(Accepted for publication October 5, 2007.)
To the Editor:—We enjoyed reading the recent editorial and review article about optimal tidal volume \( (V_T) \) in patients without acute lung injury.\(^1\)\(^2\) Overstretching healthy lungs with “traditional” \( V_T \) in the range of 10–15 mL/kg predicted body weight has been shown to trigger inflammatory and procoagulant alveolar responses. Furthermore, synergism rather than additivity between ventilator-induced alveolar stress and other injurious pulmonary factors (sepsis, ischemia-reperfusion, hypoxia-reoxygenation, major trauma and surgery) has been incriminated in damaging the alveolocapillary barrier. Ultimately, a multiple hit concept has emerged to explain the pathophysiologic mechanisms of acute lung injury.

We fully agree that protective ventilatory strategies \( (V_T) \) of 6 mL/kg predicted body weight, inspiratory plateau pressure \((P_{PEEP})\) levels >5 cm \( H_2O \) currently applied in the intensive care unit should also be adopted to manage surgical patients with “vulnerable” lungs (e.g., ongoing inflammatory/infectious disease, lung resection, major trauma and surgery). Unfortunately, in the majority of surgical patients with “healthy” lungs and no acute lung injury risk factors, the proposed ventilatory guidelines \( (V_T < 10 \text{ mL/kg predicted body weight}, \text{inspiratory plateau pressure } < 20 \text{ cm } H_2O, \text{PEEP } > 5 \text{ cm } H_2O) \) will little influence the incidence and severity of postoperative respiratory complications. Indeed, in this large population group, postoperative atelectasis is the commonest problem and the major cause of hypoxemia and nosocomial pneumonia. Accordingly, preventing atelectasis should be considered as an important objective in perioperative management.\(^3\)

After anesthesia induction in the supine position, functional residual capacity is markedly reduced (approximately 0.7–1.3 l), and atelectasis develops in the dependent part of the lungs as a result of the loss of inspiratory muscle tone, cephalad diaphragm displacement, intrathoracic shift of blood volume, and oxygen resorption.\(^4\) Starting from a lower functional residual capacity, the inspiratory–expiratory cycles are completed on a lesser compliant part of the pressure–volume continuum ranging from variable degree of alveolar collapse (dependent areas) to a variable degree of overdistension (nondependent areas) that translates into ventilation–perfusion mismatch with impaired oxygenation.

References

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Besides limiting alveolar trauma with low $V_T$, attenuating the loss of functional residual capacity and preventing the formation of atelectasis should be attempted by a stepwise approach (fig. 1): (1) application of continuous positive airway pressure and PEEP during the induction of anesthesia; (2) titration of low to moderate PEEP levels according to physiologic indices (lower inflection point of the pressure-volume curve, oxygenation indices, hemodynamics) and/or lung imaging techniques (e.g., electrical thoracic impedance); (3) intraoperative lung recruitment maneuvers (manual inflation up to the vital capacity, “ramp” PEEP elevation up to 20 cm H$_2$O); (4) use of inspiratory oxygen concentration less than 80%; and (5) postoperative lung expansion strategies, including postural changes, early mobilization, and deep breathing exercises, as well as noninvasive ventilatory support.

Whenever possible, partial ventilatory modes (assist-controlled, pressure-support, bilevel positive airway pressure) through facial or laryngeal masks should be considered to avoid tracheal reintubation, to reduce the duration of mechanical ventilation, and to promote active displacement of the dependent part of the diaphragm. Intraoperatively, bilevel positive airway pressure ventilation has been shown to improve oxygen indices by decreasing ventilation-perfusion mismatch. Likewise, reversal of atelectasis and hypoxemia after major thoracic and abdominal surgery has been successfully achieved with noninvasive ventilatory techniques that resulted in a reduced need for reintubation and a lower incidence of pneumonia and sepsis.

To date, further randomized controlled trials are needed to question whether a multimodal lung approach effectively prevents the formation of lung atelectasis and reduces the incidence of other pulmonary complications (pneumonia, respiratory failure, hypoxemia necessitating oxygen therapy) after various types of surgical procedures.

In Reply:—We thank Dr. Licker et al. for their comments on our article about optimal ventilator strategies in patients without acute lung injury. Indeed, oversstretching lungs with conventional and abnormally high tidal volumes during surgery has been shown to trigger procoagulant and proinflammatory alveolar responses in patients with healthy lungs, while not being particularly useful to prevent intraoperative atelectasis. When we consider the concept of “multiple hits” to explain the pathophysiologic mechanisms of acute lung injury, a protective ventilatory strategy (using “normally sized” tidal volume to prevent lung stretch) is certainly indicated in the management of surgical patients with lungs at risk for lung injury (e.g., with systemic inflammatory response syndrome, major trauma, major surgery). In this context, we would like to stress that the terminology chosen for a strategy aiming at prevention of oversstretching the lungs (conventional vs. low tidal volumes) is wrong and maybe even misleading. Instead of “lower” tidal volumes, we should use the term “normal” or “normally sized” tidal volumes. It is like traffic speeding: traffic speeding during rush hours is very dangerous—but traffic.

Fig. 1. Perioperative multimodal lung-protective approach. ALI = acute lung injury; ARDS = adult respiratory distress syndrome; BiPAP = bilevel positive airway pressure; CMV = controlled mechanical ventilation; CPAP = continuous positive airway pressure; Intraop = intraoperative; MODS = multiple organ dysfunction syndrome; PEEP = positive end-expiratory pressure; PSV = pressure-support ventilation; SIRS = systemic inflammatory response syndrome; $V_T$ = tidal volume.

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speeding is always dangerous, even when there are not so many other cars on the road; therefore, regulations mandate that we never drive faster than the speed limit. The size of a normal tidal volume is approximately 6 ml/kg for all mammals—we should always consider use of normally sized tidal volumes rather than (very) high tidal volumes.

We agree that ventilation with normal tidal volumes as proposed in our review may not prevent the development of postoperative atelectasis. Although limited evidence supports the use of higher positive end-expiratory pressure, intraoperative recruitment maneuvers, lower oxygen fraction, and postoperative noninvasive ventilation, a multimodal lung-protective approach has not been tested.

Although postoperative pulmonary complications are common and associated with significant morbidity, few studies investigated the influence of intraoperative ventilator and nonventilator management (e.g., fluid balance, transfusions). Indeed, randomized controlled trials are needed to answer whether a multimodal lung-protective approach effectively prevents the formation of atelectasis and reduces the incidence of acute lung injury and other pulmonary complications after various types of surgical procedures.

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(accepted for publication October 23, 2007.)

To the Editor—I read with interest the brief report by Dr. Al-Nabhani et al.1 on problems of monitoring end-tidal carbon dioxide in extremely low-birth-weight infants during perioperative period. For the monitoring of end-tidal carbon dioxide in neonates, I agree that it is necessary to sample alveolar gases to avoid the dilution of carbon dioxide by dead space created by ventilating devices such as the endotracheal tube adaptor, the Y-piece of the breathing circuit, and even the T-piece for carbon dioxide sampling, and it is necessary to insert a catheter into the endotracheal tube for sampling of alveolar gases.

For sampling of alveolar gases without using an endotracheal catheter, an endotracheal tube with end-tidal carbon dioxide monitoring port (Mallinckrodt Inc., St. Louis, MO) is available. As shown in figure 1, the lumen for end-tidal carbon dioxide sampling extends to near the distal end of endotracheal tube. The outside diameter of the 3.0-mm uncuffed tube with monitoring port is 4.5 mm, compared with 4.3 mm for a standard uncuffed tube. Although the endotracheal tube with monitoring port is slightly larger in size by 0.2 mm, the difference is negligible. I have never had any problems with endotracheal intubation. With use of this tube, one can avoid the insertion of the catheter into the endotracheal tube, and hence avoid related complications.

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Reference


In Reply—We are delighted that our report has stimulated some interesting discussion on the challenges of end tidal carbon dioxide monitoring. Dr. Her describes his experience with a new type of endotracheal tube, which has a built-in end tidal carbon dioxide monitoring port (Mallinckrodt Inc., St. Louis, MO). We agree that the complication seen in our patient could have been avoided with this form of tube because dislodgement and distal migration are less likely. There are some other advantages that should be noted. Because the monitoring line does not occupy the inner lumen, airway resistance is not increased. This is particularly relevant for very low-birth-weight infants, where 2.0- to 2.5-mm uncuffed endotracheal tubes are commonly used and airway resistance is most likely to be affected. This type of tube can be easily used with an appropriate end tidal measuring system, provided the sample volume aspirated does not compromise the delivered tidal volume.

There are some limitations that need to be pointed out. The additional tubing may become entangled with other tubes (e.g., nasogastric...
Limitations of Genetic Findings That Are Not in Hardy-Weinberg Equilibrium

To the Editor.—Zaugg et al. report an association between the Arg389Gly (rs1801253) single nucleotide polymorphism of the β1-adrenergic receptor and adverse cardiac outcomes occurring within 1 yr of spinal anesthesia in patients with clinically important coronary artery disease. Although quite interesting, this report may be flawed by an important statistical methodology error.

The reported genotypes of rs1801253 are not in Hardy-Weinberg equilibrium ($P = 4.2 \times 10^{-7}$) and have a lower than expected number of heterozygotes. Publicly available genotyping demonstrates that the Arg389Gly variant is generally found to be in Hardy-Weinberg equilibrium. The most frequent cause of reduced heterozygote expression is genotyping error caused by low amplification of one of the two alleles in the genotyping process. Examination of genotyping intensity plots will frequently, but not always, identify such errors. With such a markedly abnormal result, the authors would be advised to regenotype this single nucleotide polymorphism using another genotyping platform, preferably by an independent laboratory, to confirm their findings.

The reader is referred to an informative description of Hardy-Weinberg equilibrium in the same issue of Anesthesiology for an explanation of this important quality control measure in genotyping studies. Guidance for quality control and reporting the results of genotyping studies have recently been provided. Specifically, measures to assess the quality of genotype data should include (1) excluding single nucleotide polymorphisms with low genotyping frequencies, (2) excluding single nucleotide polymorphisms not in Hardy-Weinberg equilibrium, (3) performing genotyping on known study sample duplicates or publicly available samples to confirm accuracy of the genotyping methods, and (4) other methodologic and statistical techniques to ensure data quality. Accordingly, the association reported by Zaugg et al. should be regarded with considerable caution until confirmation in other cohorts.

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References

In Reply.—We thank Drs. Body and Schwinn for their critical remarks on our study. To clarify, our double-blinded, placebo-controlled trial was primarily designed to test the hypothesis that the perioperative administration of bisoprolol would reduce the incidence of cardiovascular complications in patients with or at risk for coronary artery disease undergoing surgery with spinal nerve block. However, because single nucleotide polymorphisms of the β-adrenergic receptor genes may act as disease modifiers, biologically important nonsynonymous coding variants of the β-adrenergic receptor were determined in our study population. This analysis showed that carriers of at least one Gly allele of the β1-adrenergic receptor polymorphism Arg389Gly experienced a higher number of adverse events than Arg homozygotes. Drs. Body and Schwinn raised concerns with respect to genotyping errors based on the observed deviation from Hardy-Weinberg equilibrium for this particular polymorphism in our trial. Genotyping error is indeed one of the many possible sources of Hardy-Weinberg disequilibrium. To exclude this possibility in our trial, we have carefully regenotyped all patients for the Arg389Gly polymorphism using internal controls for wild-type, heterozygous, and mutant

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In Reply.—We thank Drs. Body and Schwinn for their critical remarks on our study. To clarify, our double-blinded, placebo-controlled trial was primarily designed to test the hypothesis that the perioperative administration of bisoprolol would reduce the incidence of cardiovascular complications in patients with or at risk for coronary artery disease undergoing surgery with spinal nerve block. However, because single nucleotide polymorphisms of the β-adrenergic receptor genes may act as disease modifiers, biologically important nonsynonymous coding variants of the β-adrenergic receptor were determined in our study population. This analysis showed that carriers of at least one Gly allele of the β1-adrenergic receptor polymorphism Arg389Gly experienced a higher number of adverse events than Arg homozygotes. Drs. Body and Schwinn raised concerns with respect to genotyping errors based on the observed deviation from Hardy-Weinberg equilibrium for this particular polymorphism in our trial. Genotyping error is indeed one of the many possible sources of Hardy-Weinberg disequilibrium. To exclude this possibility in our trial, we have carefully regenotyped all patients for the Arg389Gly polymorphism using internal controls for wild-type, heterozygous, and mutant
Newborns and Anesthetic Neurotoxicity

To the Editor:—We read with interest Dr. Anand’s Editorial View, “Anesthetic Neurotoxicity in Newborns: Should We Change Clinical Practice?” but we are concerned that readers may misinterpret his indication regarding postnatal day 35 (P35) rhesus monkeys: “anesthetic neurotoxicity primarily results from apoptosis in rodents, . . . whereas infant monkeys at P5 (but not at P35) exhibit both excitotoxicity and apoptosis.” Although the report referenced by Dr. Anand in regard to P35 monkeys did not find a neurotoxic effect, it used one control and one experimental sample of n = 3. For each indicator of neurotoxicity, the SDs bracketing the observed results were far greater than the observed difference between the control group and the anesthetized group, such that a confidence interval around each observed difference includes levels of neurotoxicity that cannot be dismissed. Accordingly, the neurotoxicity of anesthetics has not been established beyond age P5 in a primate model. Absence of evidence is (still) not evidence of absence.

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