supports the time-honored clinical strategy of maintaining a normal arterial blood pressure with a normal to low heart rate during anesthesia in patients with coronary artery disease.

The authors carefully determined whether a criterion value for PRQ other than 1.0 mmHg · min · beat^{-1} was a better predictor of ischemia. This strategy certainly makes sense because the original study in dogs[3] was done with a uniform stenosis and because patients come to surgery with lesions of varying severity. Unpublished studies from my laboratory demonstrate that ischemia occurs at a PRQ less than 1.0 mmHg · min · beat^{-1} with a less severe stenosis and at a PRQ greater than 1.0 mmHg · min · beat^{-1} with a more severe stenosis than that used in the original study.[3] Because stenosis severity probably varied in Gordon *et al.*'s patients, no single PRQ value would be expected to define an ischemic threshold for the entire population, yet a threshold might well be defined in each subject. The PRQ concept predicts that ischemia should lessen if blood pressure and heart rate are adjusted to increase PRQ, but this intervention has not yet been tested in individual patients.

The PRQ concept certainly has limitations, many of which were discussed in the original publication.[3] The concept is best suited to patients with good left ventricular function who have stable coronary lesions. That the PRQ fared as well as it did in Gordon *et al.*'s diverse population is remarkable.

CHARLES W. BUFFINGTON, M.D.
Professor of Anesthesiology
Department of Anesthesiology
University of Pittsburgh
Pittsburgh, Pennsylvania 15261

REFERENCES

1. Gordon MA, Urban MK, O'Connor T, Barash PG: Is the pressure rate quotient a predictor or indicator of myocardial ischemia as measured by ST-segment changes in patients undergoing coronary artery bypass surgery? ANESTHESIOLOGY 74:848–853, 1991
2. Buffington CW: Hemodynamic determinants of ischemic myocardial dysfunction in the presence of coronary stenosis in dogs. ANESTHESIOLOGY 63:651–662, 1985
3. Fuster V, Badimon L, Cohen M, Ambrose JA, Badimon JJ, Cheesbro J: Insights into the pathogenesis of acute ischemic syndromes. Circulation 77:1213–1220, 1988
4. Fleiss JL: Statistical Methods for Rates and Proportions. New York, John Wiley & Sons, 1973, p 6

(Accepted for publication July 15, 1991.)

Anesthesiology
75:711, 1991

In Reply:—Dr. Buffington raises questions regarding data from our study, which was based upon his original investigation.[1] The four patients who came to the operating room with ischemia do not represent patients with unstable angina. These patients did not exhibit the hallmark of unstable angina: increased frequency and/or severity of anginal symptoms. Rather, these symptoms were similar in magnitude to their preoperative pattern.

The second issue Dr. Buffington raises is whether sensitivity and specificity are more relevant to clinical practice than is the positive predictive value. These indices are based on similar observations:

$$\text{Sensitivity} = TP/(TP + FN)$$

$$\text{Specificity} = TN/(TN + FP)$$

$$\text{Positive predictive value} = TP/(TP + FP)$$

$$\text{Negative predictive value} = TN/(TN + FN)$$

where TN = true negative; TP = true positive; FN = false negative; and FP = false positive.

We would argue that the predictive value is more meaningful to the clinician.[2] For a *given event,* the anesthesiologist wishes to know whether pressure–rate quotient (PRQ) < 1 predicts ischemia. In the clinical setting, even in patients with good left ventricular function, the positive predictive value was poor, despite an acceptable sensitivity. To put it another way: when the PRQ is *greater than 1,* ischemia is unlikely (negative predictive value). In contrast, if PRQ < 1, there is only a small likelihood that ischemia is present. We believe that the graphic representation of our data supports our conclusions. The relationship between myocardial ischemia (ECG) and different PRQ values is *inconsistent.*

The degree of coronary stenosis may affect the relevance of the PRQ concept. In a clinical setting, however, as Dr. Buffington states, dynamic constriction of the coronary arteries can occur. How well the "threshold" PRQ can predict ischemia remains to be defined. Two additional studies using ECG as the ischemia monitor also suggest that at various PRQs, ischemia could not be reliably predicted in patients.[3,4] Each report noted, as has Buffington, the difficulties in extrapolating data from an animal model to the patient with ischemic heart disease.

MICHAEL A. GORDON, M.D.
MICHAEL K. URBAN, M.D.
TERESA O'CONNOR, M.P.H.
PAUL G. BARASH, M.D.
Department of Anesthesiology
Yale University School of Medicine
333 Cedar Street
P.O. Box 3333
New Haven, Connecticut 06510

REFERENCES

1. Buffington CW: Hemodynamic determinants of ischemia in myocardial dysfunction in the presence of coronary stenosis in dogs. ANESTHESIOLOGY 63:651–62, 1985
2. Feinstein AR: Clinical Epidemiology: The Architecture of Clinical Research. Philadelphia, WB Saunders, 1985, pp 434–436
3. Leung JM, O'Kelly B, Browner W, Tubau J, Hollenberg M, Mangano D: Prognostic importance of postbypass regional wall motion abnormalities in patients undergoing coronary artery bypass graft surgery. ANESTHESIOLOGY 71:16–25, 1989
4. Harris S, Gordon M, Urban M, O'Connor T, Barash P: The "pressure–rate quotient" is not an indicator of myocardial ischemia in humans: An echocardiographic evaluation (abstract). ANESTHESIOLOGY 73:A157, 1990

(Accepted for publication July 15, 1991.)