

## Q: Can brain natriuretic peptide identify noncardiac surgery patients at high risk for cardiac events?

### ALI USMANI, MD

Department of Hospital Medicine, Cleveland Clinic  
Clinical Assistant Professor of Medicine,  
Cleveland Clinic Lerner College of Medicine,  
Cleveland, OH

### PRIYANKA SHARMA, MD

Department of Hospital Medicine,  
Cleveland Clinic, Cleveland, OH

### ASHISH ANEJA, MD

Department of Hospital Medicine, Cleveland Clinic  
Assistant Professor of Medicine,  
Cleveland Clinic Lerner College of Medicine,  
Cleveland, OH

**A:** Emerging data indicate that preoperative testing for brain natriuretic peptide (BNP) and its related compound, NT-proBNP, is beneficial in identifying patients at high risk for major adverse cardiac events following noncardiac surgery. These major events include acute coronary syndromes, arrhythmias, heart failure, myocardial infarction, and stroke, which constitute a significant source of morbidity and mortality in the perioperative period.

#### Prognostic and risk-stratifying value of BNP

The prohormone BNP is released from the myocardial cells in the left ventricle in response to volume expansion and is cleaved into BNP and its inactive N-amino terminal fragment (NT-proBNP). These markers are used to assess left ventricular dysfunction and to risk-stratify patients with acute coronary syndromes and heart failure.<sup>1</sup> Plasma BNP also provides prognostic information in patients with chronic heart failure and those with asymptomatic or minimally symptomatic left ventricular dysfunction.<sup>2</sup>

#### Evidence on BNP and NT-proBNP in noncardiac surgery

A number of recent studies indicate that BNP and NT-proBNP have similar prognostic value in patients scheduled for noncardiac surgery.

Feringa and colleagues prospectively evaluated 335 patients undergoing abdominal aortic aneurysm repair (46%) or lower extremity bypass surgery (54%).<sup>3</sup> Preoperative plasma NT-proBNP was measured at a mean of 24 days before surgery. All patients

also underwent dobutamine stress echocardiograms. Multivariable analysis revealed that an NT-proBNP level of 319 ng/L or greater was the strongest predictor of all-cause mortality and major adverse cardiac events among all variables assessed, including age, cardiac risk score, echocardiographic results, and cardiac medications.

Similarly, Dernellis and Panaretou prospectively studied 1,590 patients undergoing noncardiac surgical procedures, of which 40% were orthopedic and 30% were abdominal.<sup>4</sup> Patients had their preoperative BNP level measured within 3 days before surgery and also were risk-stratified according to the Goldman multifactorial cardiac risk index. The authors found that patients who were at low preoperative clinical risk (as defined by the Goldman cardiac risk index) but still suffered perioperative cardiac events were successfully identified by a BNP level of 189 pg/mL or greater. They concluded that BNP is a stronger predictor of postoperative events than is the Goldman cardiac risk index. This study was limited, however, by the fact that the clinicians were not blinded to the BNP levels.

In a prospective study of 190 patients undergoing noncardiac surgery (158 major and 32 minor procedures), Yeh et al found that NT-proBNP was the only factor that was independently associated with postoperative cardiac complications ( $P < .001$ ) among several factors assessed (including age, clinical cardiac impairment, and American Society of Anesthesiologists fitness class).<sup>5</sup> An NT-proBNP level of 450 ng/L or greater had a sensitivity of 100% and a specificity of 82.9% in predicting postoperative cardiac complications in this study.

Gibson and colleagues conducted a prospective

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observational cohort study of 190 high-risk patients undergoing major noncardiac surgery.<sup>6</sup> They evaluated patients using plasma BNP levels measured a day before surgery and clinical risk assessment according to the Revised Cardiac Risk Index (RCRI). BNP was found to be a significant predictor of postoperative cardiac events ( $P < .001$ ) and superior to the RCRI. A plasma BNP level of 108.5 pg/mL or greater predicted cardiac events with sensitivity and specificity of 87%, a positive predictive value of 42%, and a negative predictive value of 98%.

In a study of 400 patients undergoing thoracic surgery for lung cancer, an elevated preoperative NT-proBNP level strongly and independently predicted postoperative atrial fibrillation, with a positive predictive value of 68% and a negative predictive value of 93% (67% sensitivity and 93% specificity).<sup>7</sup>

Interestingly, in a small prospective study of patients undergoing hip arthroplasty, preoperative BNP levels were significantly higher in patients who had a hypotensive response to surgery than in those who were normotensive after surgery.<sup>8</sup>

### Conclusions

Elevated levels of BNP and NT-proBNP appear to identify patients at risk for a variety of adverse postoperative cardiovascular events. Further investigations are needed to determine the role of these tests

in the risk stratification of patients undergoing non-cardiac surgery.

### REFERENCES

1. Morrow DA, de Lemos JA, Blazing MA, et al. Prognostic value of serial B-type natriuretic peptide testing during follow-up of patients with unstable coronary artery disease. *JAMA* 2005; 294:2866–2871.
2. Tsutamoto T, Wada A, Maeda K, et al. Plasma brain natriuretic peptide level as a biochemical marker of morbidity and mortality in patients with asymptomatic or minimally symptomatic left ventricular dysfunction. Comparison with plasma angiotensin II and endothelin-1. *Eur Heart J* 1999; 20:1799–1807.
3. Feringa HH, Schouten O, Dunkelgrun M, et al. Plasma N-terminal pro-B-type natriuretic peptide as long-term prognostic marker after major vascular surgery. *Heart* 2007; 93:226–231.
4. Dernelis J, Panaretou M. Assessment of cardiac risk before non-cardiac surgery: brain natriuretic peptide in 1590 patients. *Heart* 2006; 92:1645–1650.
5. Yeh H-M, Lau H-P, Lin J-M, et al. Preoperative plasma N-terminal pro-brain natriuretic peptide as a marker of cardiac risk in patients undergoing elective non-cardiac surgery. *Br J Surg* 2005; 92:1041–1045.
6. Gibson SC, Payne CJ, Byrne DS, Berry C, Dargie HJ, Kingsmore DB. B-type natriuretic peptide predicts cardiac morbidity and mortality after major surgery. *Br J Surg* 2007; 94:903–909.
7. Cardinale D, Colombo A, Sandri MT, et al. Increased perioperative N-terminal pro-B-type natriuretic peptide levels predict atrial fibrillation after thoracic surgery for lung cancer. *Circulation* 2007; 115:1339–1344.
8. Terasako K. Perioperative plasma concentrations of atrial and brain natriuretic peptides in patients undergoing hip arthroplasty. *Anaesth Intensive Care* 2002; 30:588–590.

**Correspondence:** Priyanka Sharma, MD, Department of Hospital Medicine, Cleveland Clinic, 9500 Euclid Avenue, S70, Cleveland, OH 44195; sharmap3@ccf.org.