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Original Contributions

IMPACT OF POINT-OF-CARE B-TYPE NATRIURETIC PEPTIDE (BNP) MEASUREMENT ON MEDICAL DECISION-MAKING FOR OLDER EMERGENCY DEPARTMENT PATIENTS WITH DYSPNEA

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□ **Abstract—Measurement of B-type natriuretic peptide (BNP) has been shown to aid in the Emergency Department (ED) diagnosis of heart failure. We sought to determine how point-of-care BNP measurement influences real-world medical decision-making. Using a commercially available, point-of-care assay, BNP levels were measured in a convenience sample of ED patients over the age of 55 years who complained of dyspnea. Blinded to BNP results, emergency physicians were asked to formulate a differential diagnosis and management plan for each patient. Immediately thereafter, BNP results were disclosed and the physicians were asked what (if any) decisions they would change. With physicians blinded to BNP results, 24 of 88 patients (27%) were given a primary diagnosis of heart failure, and 18 patients (20%) were given a secondary or alternative diagnosis of heart failure. For the former group, disclosure of BNP results resulted in no changes in diagnosis or management. For the latter group, disclosure of BNP results caused heart failure to become the primary diagnosis in 4 patients (22%), and led to five changes in medical management. For the 46 patients initially given neither a primary nor secondary diagnosis of heart failure, disclosure of BNP results caused heart failure to become the primary diagnosis in one patient (2%) and a secondary diagnosis in 4 patients (9%), and led to five changes in medical management. Thus, for ED patients with a primary clinical diagnosis of heart failure, BNP testing had no impact on medical decision-making. However, for other patients with dyspnea, elevated BNP levels did influence medical decision-making, particularly when heart failure was in the differential diagnosis. © 2006 Elsevier Inc.**

□ **Keywords—BNP; point-of care testing; dyspnea; heart failure; medical decision-making**

INTRODUCTION

There are currently 5 million Americans who have heart failure, with approximately 500,000 new cases arising annually (1). Heart failure is the primary diagnosis for nearly 1,000,000 hospitalizations per year and is the most common cause for hospitalization in adults over the age of 65 years (1). The vast majority of patients who require hospitalization for heart failure present initially to the Emergency Department (ED) with dyspnea as a primary symptom (2). The rapid and accurate differentiation of heart failure from other causes of dyspnea remains a clinical challenge, as signs and symptoms are often ambiguous (3,4). Misdiagnosis can result in morbidity because a treatment strategy for heart failure may be hazardous to a patient with another condition (such as chronic obstructive pulmonary disease), and vice versa.

B-type natriutretic peptide (BNP) is a cardiac neurohormone secreted from the ventricles in response to

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pressure overload, and levels of circulating BNP are elevated in patients with heart failure (5). BNP levels have been used successfully in the ED setting to differentiate patients with dyspnea due to heart failure from those with dyspnea due to other causes, with an accuracy approaching 85% using a cut-off of 100 pg/mL (6). Although BNP testing has been introduced in large numbers of hospitals in the United States and Europe, the appropriate role for BNP measurement in the general evaluation and management of ED patients with dyspnea remains incompletely resolved (7).

A recent study has suggested that a strategy incorporating BNP measurements into the routine evaluation of ED patients with dyspnea reduces rates of hospital admission, length of stay, and hospital costs (8). However, from the standpoint of the individual ED patient, the effect of a single BNP measurement on diagnosis and management is not known.

We sought to determine what impact the addition of BNP testing has on the real-world diagnosis and management of ED patients with dyspnea. Our primary objective was to determine how knowledge of a patient's serum BNP level influences the practicing emergency physician's decisions with regard to diagnosis, treatment, disposition, and the need for additional testing.

METHODS

This prospective, observational study was performed from July–August of 2002 at an urban, university-affiliated, adult ED with a 4-year Emergency Medicine (EM) residency and an annual census of 55,000 visits. The study was approved by the institution's Human Research Committee. In anticipation of the study, all ED attendings and senior EM residents at our institution were familiarized with the diagnostic use of BNP—including the test characteristics reported in the Multinational BNP study (6)—through preprinted handouts and formal presentations at faculty meetings and resident conferences.

Between the hours of 8:00 a.m. and 5:00 p.m., Monday through Friday, trained research assistants identified all subjects over the age of 55 years who had presented to triage with a chief complaint of dyspnea, and who were undergoing an ED evaluation that included at least a chest radiograph (CXR) and blood draw. Subjects were enrolled in the study only if they were able to give informed consent.

For each subject, a research assistant obtained 2 cc of whole blood and measured a BNP level using a commercial, point-of-care immunoassay (Triage® BNP Test; Biosite, San Diego, CA). The research assistant then approached the senior ED physician (EM attending or senior EM resident) who had clinically evaluated the subject (history, physical examination, and chest radiograph) and, without disclosing the BNP result, asked and recorded answers to a series of structured questions regarding the subject's most likely primary diagnosis, alternative or secondary diagnoses, expected disposition, and plan for treatment or additional testing. The research assistant then revealed the subject's serum BNP level to the senior ED physician and recorded answers to the same series of questions.

Because this was an observational study in which each set of physician responses served as its own control, we used simple descriptive statistics to quantify the percent of diagnostic and management decisions that changed as a result of knowing BNP levels. For groups of subjects, BNP levels are reported as medians with ranges.

RESULTS

Of 91 subjects enrolled, 88 were included in the study. Two subjects were excluded because of a failure of the point-of-care device, and one was excluded because of a protocol violation.

Median age of subjects was 73.5 years. Forty-eight subjects (55%) were women. Seventy-two (82%) were admitted to the hospital.

A total of 25 emergency physicians participated in the study. Thirteen were attending physicians, with experience ranging from $<$ 1 year to $>$ 20 years in clinical practice. Twelve were senior (PGY-4) residents.

With physicians blinded to BNP results, 24 subjects (27%) were given a primary clinical diagnosis of heart failure, and 18 subjects (20%) were given a secondary or alternative diagnosis of heart failure. For 46 subjects (52%), heart failure was not on the initial differential diagnosis. Median BNP levels for these three groups of subjects were 705 (range 97 to $>$1300), 495 (range 21 to $>$1300), and 77 (range 1 to $>$1300), respectively.

Among the group of subjects given a primary clinical diagnosis of heart failure, revelation of BNP levels to physicians did not result in any reported changes in diagnostic or management decisions. Among the group given a secondary or alternative diagnosis of heart failure, unblinding of BNP levels caused heart failure to become the primary diagnosis in 22% of subjects. Among the group for whom heart failure was not initially in the differential diagnosis, disclosure of BNP levels led to heart failure becoming the primary diagnosis in 2% and a secondary or alternative diagnosis in 9% of subjects. A total of 10 changes in medical management on the basis of BNP levels were reported (Table 1).