Chest radiographs and BNP levels provided complementary information beyond clinical findings for diagnosing heart failure

Knudsen CW, Omland T, Clopton P, et al. **Diagnostic value of B-type natriuretic peptide and chest radiographic findings in patients with acute dyspnea.** Am J Med. 2004;116:363-8.

Question

In patients with acute dyspnea, how do chest radiographic findings and circulating B-type natriuretic peptide (BNP) levels compare for diagnosing heart failure (HF)?

Methods

Design: Blinded comparison of chest radiographs and BNP levels with confirmatory clinical diagnosis.

Setting: 5 teaching hospitals in the United States and 2 in Europe.

Patients: 880 patients (mean age 64 y, 55% men) presenting to the emergency department (ED) with a principal complaint of shortness of breath (either the sudden onset of dyspnea with no history of chronic dyspnea or an increase in the severity of chronic dyspnea); and had complete information on BNP, historical, clinical, and electrocardiographic data, and chest radiographic findings. Patients with dyspnea not caused by HF (e.g., stabbing injuries, trauma, and pneumothorax) were excluded.

Description of tests: Chest radiographs were obtained in the ED, and the presence of cardiomegaly, cephalization, interstitial edema, alveolar edema, pleural effusion, hyperinflated lungs, and pneumonic infiltrates, as interpreted by a radiologist, was recorded. During initial evaluation, BNP levels were measured using the Triage BNP test (Biosite Diagnostics, San Diego, CA, USA)—a fluorescence immunoassay for the quantitative determination of BNP in whole blood and plasma specimens. BNP levels were analyzed within 4 hours or were centrifuged, frozen, and analyzed 1 to 2 days later.

Diagnostic standard: About 30 days after the ED visit, the results of electrocardiography, chest radiography, echocardiography, clinical test results, consultations, and medical record information were used by 2 independent cardiologists to categorize cases as those caused by acute HF or those having noncardiac causes.

Outcomes: Sensitivity, specificity, and positive and negative likelihood ratios for the diagnosis of acute HF.

Main results

447 of 880 patients (51%) had a final diagnosis of acute HF. Of these, 90% had BNP levels ≥ 100 pg/mL. 576 of 880 patients (66%) fulfilled the Framingham criteria for HF. Sensitivity, specificity, and positive and negative likelihood ratios for radiographic findings and cutpoints of BNP levels at ≥ 100, 200, and 300 pg/mL are in the Table. In a multivariate analysis, additional information beyond the clinical predictors of acute HF was provided by BNP at a cutpoint of ≥ 100 pg/mL (odds ratio [OR] 12.3, 95% CI 7.4 to 20.4) and chest radiographic variables of cardiomegaly (OR 2.3, CI 1.4 to 3.7), cephalization (OR 6.4, CI 3.3 to 12.5), and interstitial edema (OR 7.0, CI 2.9 to 17).

Conclusion

In patients with acute dyspnea, chest radiographic variables and circulating B-type natriuretic peptide levels provided complementary diagnostic information beyond clinical predictors for diagnosing heart failure.

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Diagnostic characteristics of chest radiographic findings and B-type natriuretic peptide (BNP) levels for detecting heart failure*

Tests	Sensitivity (95% CI)	Specificity (CI)	+LR	–LR
Cardiomegaly	79% (75 to 83)	80% (76 to 84)	3.98	0.26
Cephalization	41% (37 to 46)	96% (93 to 97)	9.41	0.61
Interstitial edema	27% (23 to 31)	98% (96 to 99)	12.67	0.72
BNP (pg/mL)				
≥ 100	90% (86 to 92)	75% (71 to 79)	3.66	0.14
≥ 200	80% (76 to 84)	87% (83 to 90)	6.08	0.23
≥ 300	71% (67 to 75)	90% (87 to 93)	7.18	0.32

*Diagnostic terms defined in Glossary; LRs calculated from data in article; CIs provided by author.

Commentary

A rapid and accurate investigation of the symptom of acute shortness of breath is vital. Clinical and chest radiographic findings have long been used to diagnose HF. Echocardiography is now also used frequently. Recently, BNP levels have been proposed to add diagnostic power in patients with acute dyspnea (1). A series of studies has tested the utility of BNP in the emergency diagnosis of HF (2, 3). The study by Knudsen and colleagues compared the diagnostic value of BNP levels with chest radiographs as adjuncts to clinical findings. Unfortunately, 706 patients were excluded from the original cohort (n = 1586) because they lacked complete information.

Knudsen and colleagues found that both chest radiographic variables and BNP levels provide complementary diagnostic information beyond clinical predictors. The sensitivity of BNP at a low cutpoint (100 pg/mL) compared favorably with chest radiographic findings. This means that BNP levels could be used to rule out HF. However, the specificity of cephalization and interstitial edema was higher than even the highest BNP cutpoint (400 pg/mL). Therefore, some of the classic radiographic findings can better rule in HF.

Hence, BNP levels should not be used instead of chest radiography, because the diagnostic value of both tests is complementary. As pointed out by Knudsen and colleagues, the diagnosis of HF should not be based on a single test. A final study with point-of-care radiographic interpretation and rapid BNP results would be valuable.

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