

Measuring brain natriuretic peptide in suspected left ventricular systolic dysfunction in general practice: cross-sectional study

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The prevalence of heart failure is increasing.¹ Patients usually present to their general practitioner but a definitive diagnosis of left ventricular systolic dysfunction can only be achieved by cardiac imaging. Measuring plasma concentrations of brain natriuretic peptide has been advocated as a screening test that might reduce demands on cardiological services.²

We report the results of a community based study designed to investigate the effectiveness of measuring brain natriuretic peptide to diagnose left ventricular systolic dysfunction. The study was approved by the local research ethics committee.

Participants, methods, and results

General practitioners were invited to refer patients with suspected heart failure to our clinic. The results of transthoracic echocardiography were reported by a single, experienced observer (IA). Ischaemia was diagnosed if Q waves, bundle branch block, T wave inversions, or left ventricular hypertrophy were present on an electrocardiogram. Evidence of heart failure on a chest radiograph was defined as the presence of pulmonary oedema or cardiomegaly. Concentrations of brain natriuretic peptide were measured by immunoradiometric assay (Shionoria assay, Shionogi, Osaka, Japan) of plasma stored at -70°C . A concentration >17.9 pg/ml was considered abnormal based on the results of a large study of left ventricular systolic dysfunction.³

Altogether, 126 patients (68 men) with a mean age of 74.4 (SD 8.9) years were included in the study. Concentrations of the peptide were raised in the 40

patients with left ventricular systolic dysfunction (median concentration 79.4 pg/ml, interquartile range 35.9-151.0) compared with those with normal ventricular systolic function (26.7 pg/ml, 12.2-54.3; $P<0.001$). A concentration >17.9 pg/ml had a sensitivity of 88% and specificity of 34%. Choosing different cut points did not improve the predictive characteristics: at 10 pg/ml sensitivity was 92% but specificity was 18%, and at 76 pg/ml sensitivity was 66% and specificity 87%.

The prior probability that a disease exists (its prevalence) and the extent to which a test result alters the chance of the disease existing determine whether further investigation is needed; this is the likelihood ratio of positive and negative tests. In the case of heart failure it is unlikely that a single positive test result will remove the need for further cardiac imaging before treatment is started. In contrast, a negative result may give a low posterior probability of disease so that further investigations are unnecessary.

The prevalence (or prior probability) of left ventricular systolic dysfunction in this study was 32%; this is consistent with that reported in other studies.⁴ The likelihood ratio for a patient without a history of myocardial infarction, with negative results on chest radiography and electrocardiography, and with concentrations of brain natriuretic peptide below the cut off, individually and in combination, are shown in the table. Measuring the concentration of brain natriuretic peptide is the test with the lowest likelihood ratio for a negative test; thus it is the most useful. However, to be useful in clinical practice, this test must provide additional diagnostic information over that given by

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Likelihood ratios for screening tests for left ventricular systolic dysfunction. Any combination of tests is defined as being positive if any of the individual components are positive

Screening criteria	Specificity (%)	Sensitivity (%)	Likelihood ratio if test negative	Likelihood ratio if test positive	Posterior probability if test negative* (%)	Posterior probability if test positive* (%)
Myocardial infarction†	91	33	0.74	3.62	26	63
Electrocardiogram‡	87	41	0.68	3.13	24	60
Chest radiograph§	45	65	0.79	1.17	27	36
Brain natriuretic peptide¶	34	88	0.35	1.32	15	38
Myocardial infarction or						
Electrocardiogram	82	61	0.48	3.29	19	61
Chest radiograph	37	83	0.46	1.32	18	38
Brain natriuretic peptide	27	90	0.38	1.23	15	37
Myocardial infarction or electrocardiogram or						
Chest radiograph	31	83	0.53	1.22	20	36
Brain natriuretic peptide	22	91	0.42	1.17	16	35
Myocardial infarction or chest radiograph or brain natriuretic peptide	14	91	0.62	1.06	23	33
Any test	11	92	0.78	1.03	27	33

*Prevalence (prior probability) of left ventricular systolic dysfunction assumed to be 32%.

†Positive if there is a history of myocardial infarction.

‡Positive if Q waves, bundle branch block, left ventricular hypertrophy, or T wave present.

§Positive if pulmonary oedema or cardiomegaly present.

¶Positive if concentration >17.9 pg/ml.

investigations that are more readily available, which in combination yield a minimum posterior probability of 20%. Adding a test for brain natriuretic peptide to the determination of a patient's history of myocardial infarction in the diagnostic screening process reduces the posterior probability to 15%.

Comment

There seems to be a small diagnostic advantage to measuring brain natriuretic peptide in addition to performing routine investigations. However, given the therapeutic and prognostic importance of correct diagnosis, most clinicians would find a 1 in 7 chance of left ventricular systolic dysfunction unacceptably high in a patient who has not been referred for echocardiography.

Recruitment to this study relied on the general practitioners making a provisional diagnosis of suspected heart failure, and results may be different in other settings, such as population based screening for asymptomatic left ventricular systolic dysfunction. Nevertheless this study suggests that introducing

routine measurement of the plasma concentration of brain natriuretic peptide would be unlikely to improve the diagnosis of symptomatic left ventricular systolic dysfunction in the community.

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When I use a word

Fortuitous—ambiguously inappropriate to describe maternal death?

Irrespective of the pregnancy duration, if a woman dies while pregnant or in the first six weeks thereafter, the death is classified as a maternal death. The reports on confidential inquiries into maternal deaths in England and Wales subclassify maternal deaths into direct, indirect, fortuitous, and unknown. Direct maternal deaths are when the death is as a direct result of an obstetric complication or intervention. An indirect maternal death is when death follows underlying maternal disease that is exacerbated by the pregnancy. Unknown maternal deaths occur in pregnancy or in the puerperium where no underlying cause is found. Fortuitous maternal deaths are deaths that occur from causes unrelated to the pregnancy and include violent deaths and suicide.

Maternal deaths unrelated to the pregnancy do occur and are important to classify, particularly with our increasing awareness of violence against women. However, is the adjective fortuitous the appropriate word to describe these deaths? Fortuitous is derived from and has the same meaning as the Latin word *fortuitus*, that takes place by chance or accident. The first documented written use of fortuitous occurred in the mid-seventeenth century and was from the pen of the Cambridge platonist Henry More in his book, *The Argument against the Fortuitous Concourse of Atoms*. A phrase he applied after Cicero (*Concursus fortuitus*) to the action whereby according to the atomic theory of Leucippus and Democritus the universe came into being. Strictly speaking, according to etymology, fortuitous is an appropriate adjective to use to describe a random event.

Another adjective, fortunate, meaning having good luck or coming by good luck sounds similar to fortuitous. The first documented appearance of the word fortunate in written English language is in Chaucer's *Canterbury Tales* (1390). Although the word is ultimately derived from Latin (*fortunatus*, provided with good fortune) it may originally have been borrowed from old French *fortuné*, happy, since Chaucer translated from French and probably was aware of the word from that source.

Classically, a fortuitous occurrence happens by chance and is not necessarily good or bad, while something that is fortunate is

favourable but does not necessarily involve any element of chance or accident. Something that is fortuitous can also be fortunate, but unless it happened by chance or accident, the correct word to use is fortunate. This was the state of affairs until the 1920s. Robert Burchfield's *The New Fowler's Modern English* (third edition, Oxford University Press, 1996) reports that Henry Watson Fowler's *Dictionary of Modern English Usage*, published in 1926, noted that fortuitous had begun being used as a near synonym for fortunate. A fortuitous occurrence was something that happened by good fortune and not merely by chance or accident. Apparently Fowler considered this to be a malapropism as they sounded similar. Due to the similarity between the words the distinction between fortuitous and fortunate has become blurred and their frequent confusion has led to an increasing acceptance of fortuitous referring to something that happened by good chance. The *Tenth Edition of the Concise Oxford Dictionary*, the self confessed foremost authority on current English, defines fortuitous as something happening by chance rather than design or something happening by lucky chance.

A maternal death is never by lucky chance and the term fortuitous maternal death is too ambiguous. Maternal death unrelated to pregnancy is a more suitable term as it is both unambiguous and explanatory.

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