thyroid hormones at the peripheral tissues—and not TSH concentrations—reflect the clinical severity of hypothyroidism. A judicious initiation of thyroxine treatment should be guided by clinical and metabolic presentation and thyroid hormone concentrations (free thyroxine) and not by serum TSH concentrations.

We thank the laboratory staff of the division of endocrinology (Maya Kunz, Sylvia Alscher, Ursula Schild) for performing the biochemical and technical analyses.

Contributors: CM, J-JS, and BM were involved in the conceptual design, interpretation of data, critical revision of the paper, and approval of the final version. CM, PT, and MG were involved in data collection and analysis. BM and J-JS are the guarantors.

Funding: Swiss Research Foundation (grants 32.27866.89, 32.37792.93, and 32.37792.98); unconditional research grants from Sandoz Research and Roche Research Foundations (to J-JS), the Sonderprogramm zur Förderung des akademischen Nachwuchses der Universität Basel, and the Nora van Meeuwen-Häfliger Foundation (to BM).

Competing interests: None declared.

1 Zulewski H, Muller B, Exer P, Miserez AR, Staub JJ. Estimation of tissue hypothyroidism by a new clinical score: evaluation of patients with various grades of hypothyroidism and controls. *J Clin Endocrinol Metab* 1997;82:771-6.
2 Staub JJ, Althaus BU, Engler H, Ryff AS, Trabucco P, Marquardt K, et al. Spectrum of subclinical and overt hypothyroidism: effect on thyrotropin, prolactin, and thyroid reserve, and metabolic impact on peripheral target tissues. *Am J Med* 1992;92:631-42.
3 Franklyn JA, Daykin J, Betteridge J, Hughes EA, Holder R, Jones SR, et al. Thyroxine replacement therapy and circulating lipid concentrations. *Clin Endocrinol (Oxf)* 1993;38:453-9.
4 Canaris GJ, Steiner JF, Ridgway EC. Do traditional symptoms of hypothyroidism correlate with biochemical disease? *J Gen Intern Med* 1997;12:544-50.
5 Ridgway EC, Cooper DS, Walker H, Daniels GH, Chin WW, Myers G, et al. Therapy of primary hypothyroidism with L-triiodothyronine: discordant cardiac and pituitary responses. *Clin Endocrinol (Oxf)* 1980;13:479-88.

(Accepted 2 September 2002)

Cardiac troponin T in the severity assessment of patients with pulmonary embolism: cohort study

Karin Janata, Michael Holzer, Anton N Laggner, Marcus Müllner

Universitätsklinik für Notfallmedizin, Allgemeines Krankenhaus Wien, Währinger Gürtel 18-20/6D, A-1090 Vienna, Austria
Karin Janata *consultant*
Michael Holzer *specialist registrar*
Anton N Laggner *professor*
Marcus Müllner *clinical epidemiologist*

Correspondence to: M Mullner marcus.muellner@univie.ac.at

BMJ 2003;326:312–3

Right ventricular function is an important prognostic factor for pulmonary embolism.[1] Massive pulmonary embolism may lead to right ventricular failure, reduced left ventricular output, and even death.[2] Cardiac troponins are routinely applied markers of minor and major myocardial damage in patients with acute coronary syndromes. In small case series, troponin concentrations were raised in patients with massive pulmonary embolism.[3 4] The role of troponin as a prognostic factor is, however, unclear. We assessed the association between serum concentrations of cardiac troponin T and severity of pulmonary embolism as well as the role of troponin T as a predictor of mortality.

Participants, methods, and results

We assessed 136 consecutive patients who were admitted to the emergency department of a tertiary care university hospital between December 1999 and November 2001 with pulmonary embolism, confirmed by computed tomography or scintigraphy. Two patients with terminal illness and seven patients admitted after cardiac arrest out of hospital were excluded. In 106 patients troponin concentrations were determined in the first 12 hours after admission (Elecsys 2010; Roche, Mannheim, Germany). The severity of the event was classified according to the grading system by Grosser (see table A on bmj.com).[5] Right ventricular strain in the electrocardiogram was defined as right bundle branch block, T wave inversion in precordial leads, or $S_1Q_3T_3$ pattern. We used Spearman's correlation and the Wilcoxon rank sum test and constructed a receiver operating characteristic curve based on sensitivities and specificities, using various troponin values as cut offs to determine mortality in hospital. We used routine data; studies using such data are not routinely reviewed by the local ethical review board.

The median age of patients was 60 (interquartile range 43-72) years; 74 (58%) were female. Six had fulminant pulmonary embolism, in 37 it was massive, in 62 it was submassive, and in one it was minor. With increasing severity of pulmonary embolism troponin concentrations also increased (r=0.56, $P<0.001$). The median troponin concentration in patients with signs of right ventricular strain in the electrocardiogram was 0.03 ng/ml (interquartile range <0.01 to 0.06) and in patients without these signs <0.01 ng/ml (<0.01 to <0.01, $P<0.001$). Ninety three patients underwent echocardiography, of whom 63 (68%) had signs of right ventricular strain[1]; the median troponin concentration in patients with signs of right ventricular strain was 0.03 ng/ml compared with <0.01 ng/ml ($P<0.001$) in patients without right ventricular strain.

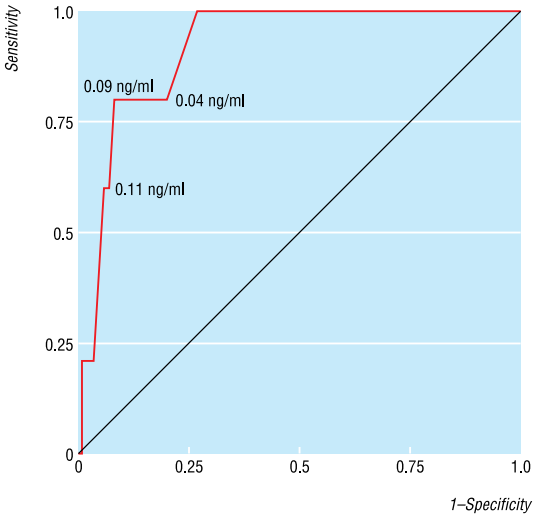
Five of 106 patients with troponin measurements died in hospital (5%); troponin concentrations were higher in patients who died than in survivors (0.18 ng/ml (0.09 to 0.18) v <0.01 ng/ml (<0.01 to 0.03), $P<0.001$). A cut-off value for troponin of 0.09 ng/ml was a suitable predictor for death in hospital (figure). The area under the curve was 0.92 (95% confidence interval 0.82 to 1.0), and the cut-off value had a sensitivity of 0.80 (0.49 to 1.0) and a specificity of 0.92 (0.87 to 0.97). The negative predictive value was 0.99 (0.93 to 1.00) and the positive predictive value 0.34 (0.10 to 0.59).

Comment

Raised concentrations of troponin T are associated with a higher in-hospital mortality in patients with pulmonary embolism. The major limitation of this study is that we do not know in how many patients pulmonary

An extra table appears on bmj.com

BMJ: first published as 10.1136/bmj.326.7384.312 on 8 February 2003. Downloaded from http://www.bmj.com/ on 28 March 2024 by guest. Protected by copyright.



Receiver operating characteristic curve of cardiac troponin T and mortality. The values at the curve indicate the respective concentrations of cardiac troponin T

embolism remained undetected. We assume that missed cases had only minor symptoms and probably a good prognosis. Another limitation is that in 21 of the 127 eligible patients (17%) troponin was not measured. Patients with missing troponin values were younger (median 47 years *v* 60 years, P=0.014). The proportion of missing troponin values was similar in survivors and non-survivors (17%). Overall, we believe that this selection bias does not invalidate our conclusion. Whether troponin measurement can be used as a tool for clinical decision making—for example, deciding whether to give thrombolytic treatment—needs confirmation in larger prospective studies.

Contributors: KJ collected the data for the pulmonary embolism registry, interpreted the data, and wrote the article. MH interpreted the data and wrote the article. ANL interpreted the data and critically revised the article. MM analysed and interpreted the data, wrote the article, and is, together with KJ, the guarantor for this paper.

Funding: None.

Competing interests: MM works part time as an editor with the *BMJ* but had nothing to do with the peer review of this paper.

1 Kasper W, Konstantinides S, Geibel A, Tiede N, Krause T, Just H. Prognostic significance of right ventricular afterload stress detected by echocardiography in patients with clinically suspected pulmonary embolism. *Heart* 1997;77:346-9.
2 Lualdi JC, Goldhaber SZ. Right ventricular dysfunction after acute pulmonary embolism: pathophysiologic factors, detection, and therapeutic implications. *Am Heart J* 1995;130:1276-82.
3 Meyer T, Binder L, Hruska N, Luthe H, Buchwald AB. Cardiac troponin I elevation in acute pulmonary embolism is associated with right ventricular dysfunction. *J Am Coll Cardiol* 2000;36:1632-6.
4 Giannitsis E, Muller-Bardorff M, Kurowski V, Weidtmann B, Wiegand U, Kampmann M, et al. Independent prognostic value of cardiac troponin T in patients with confirmed pulmonary embolism. *Circulation* 2000;102:211-7.
5 Grosser KD. Lungenembolie. Erkennung und differentialtherapeutische Probleme [Pulmonary embolism—problems in identifying and treating the condition]. *Internist* 1980;21:273-82.

(Accepted 15 August 2002)

A patient who changed my practice

Northern Ireland weather

With my appointment as a neurosurgeon in Belfast, I realised that most patients desired some personal and informal interaction. They also wanted to know more about me. Being rather reserved, I found it difficult to engage in long conversations. Also, not being a native of Northern Ireland, there were few subjects in common to talk about. After pleasantries and discussion of the medical condition, I was usually at a loss to extend the conversation further. I was aware of the sectarian troubles, but patients avoided such sensitive topics. Soon, I discovered that one topic was popular, uncontentious, and universally discussed by Protestant and Catholic alike—the weather. Good weather was an exception rather than the rule. None the less everyone enjoyed talking about the weather.

The most common question put to me by the patients was "Doctor, how do you like it over here?"

My standard answer was "It's good, especially since the troubles are over. I like it here, except for the bad weather—always cold, wet, and windy." Patients appreciated my remarks and sympathetically shared my disappointment. This weather talk not only helped me get over my initial introversion, it also enabled me to keep patients distracted during their neurological examination. On a rare sunny day I learnt to manoeuvre the dialogue impressively by saying, "It's a lovely day, isn't it?" Within a few weeks, by using the "weather card," I mastered the art of communicating effectively with the local population despite my different religious, cultural, social, and ethnic background.

Then one day I came across Mr Smith at my outpatient clinic. He was in his middle 50s with longstanding trigeminal neuralgia, a condition in which patients have intermittent severe facial pain. After the usual introduction and neurological examination, the expected question came up: "Doctor, how do you like it here?" By now I was well rehearsed with the answer. I explained how, over the years, I had come to feel at home in Northern Ireland. Mr Smith listened with interest, occasionally nodding with approval. I went on to describe the inclement weather and how difficult I found it coming to terms with it. Mr Smith was quiet and did not seem to be as appreciative as before. I continued, saying how depressing the winters were, and the summers too, with the constant rain. Mr Smith now seemed a bit disturbed. I carried on, however, relating how depressing it was to see the television weather forecast invariably showing clouds and rain over Belfast.

By now, Mr Smith was overtly restless but remained seated, more through respect than interest. I sensed that something was wrong, and, changing the subject, I said, "Mr Smith, yours doesn't seem to be a Northern Irish accent. Where are you from?" With a calm face, he stated that, although he was originally from Belfast, he had spent some 20 years abroad. He had been in Leningrad for 10 years, but found it very cold, as the temperature often dropped to −40°C. Then he spent 10 years in Brisbane, but found it too hot, with the temperatures sometimes reaching 40°C. Consequently, he opted to return home because he liked the weather in Northern Ireland. With a smile, he said, "The weather here is always pleasant, moderate, and with a lush greenery all year round." He then shook my hand, said he was pleased to meet me, and left the room, leaving me speechless.

Unable to disagree, I found myself back at square one, searching for a new topic for conversation.

Kishor A Choudhari *consultant neurosurgeon, Royal Victoria Hospital, Belfast*

BMJ: first published as 10.1136/bmj.326.7384.312 on 8 February 2003. Downloaded from http://www.bmj.com/ on 28 March 2024 by guest. Protected by copyright.