Original Article

Surveys on the use of cardiac markers in the UK

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Abstract

Background Troponin measurements are now central to the diagnosis of acute coronary syndromes and for the stratification of the severity of cardiac disease. Some laboratories have quickly adopted the new testing strategies, which include troponin measurement for the diagnosis of acute myocardial infarction, while others are still developing appropriate protocols for cardiac testing that they can support financially. However, it is not known how widespread is the adoption of these new strategies across the UK.

Methods The National Audit Committee of the Association of Clinical Biochemists commissioned two surveys in 1999 and 2001 to assess the status of cardiac markers currently being offered by laboratories in the UK and how this service might develop in the future.

Results The results show that many laboratories are continuously adapting and improving their cardiac marker testing in line with current recommendations for acute myocardial infarction. Although most laboratories are confident in the use of troponin measurement in the diagnosis of myocardial infarction, they are less confident in the use of biochemical markers in assessing prognostic outcome in the other cardiac conditions.

Conclusions Finance, staffing and equipment constraints may offer significant impediments to troponin testing with a 1-h turnaround time.

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Introduction

According to the 1999 government consultation document on myocardial infarction (MI), the overall incidence of MI is estimated to be 2·6 per 1000 population per year.[1] The criteria for the diagnosis of MI were based on the following three features: typical or compatible clinical history; sequential electrocardiographic (ECG) changes; and a rise in cardiac enzymes to at least twice the upper limit of normal for the hospital laboratory. These are the conventional criteria recommended by the World Health Organization.[2] However, a consistent body of evidence has accumulated to show that these criteria ignore a significant group of patients proven to be at high risk of subsequent cardiac events. In addition, minor rises of creatine kinase (CK)-MB have been demonstrated to be of prognostic significance, and the measurement of cardiac troponins has been shown to be clinically superior to conventional 'cardiac enzymes'.

Despite the availability of troponin assays[3] and the recommendation to replace serum cardiac enzyme measurements with troponin measurements in the diagnosis of MI,[4–9] many laboratories continue to offer cardiac enzymes for the diagnosis of MI, for financial and practical reasons. According to an international survey published recently,[10] the trend to change to troponin assays seems to be occurring earlier in the USA than in other countries. We report here two successive surveys of clinical biochemistry departments in the UK to assess their current response to the recommendations in the European/US consensus documents redefining acute MI.[6,7]

Methods

Two questionnaires were designed to investigate the use of cardiac markers offered; these were initially piloted in the 16 laboratories in Wales. Subsequently, the National Audit Committee of the Association of

Clinical Biochemists distributed the two questionnaires to clinical biochemistry laboratories in the UK. The first was distributed in June 1999; the second was distributed in July 2001 to record any change in the cardiac markers being offered by laboratories since the first survey. The questionnaires were distributed to all UK hospital laboratories represented by the regional representatives on the National Audit Committee.

Results and discussion

Two hundred questionnaires were dispatched via the regional representatives in the first survey and 142 replies were received (71%). Not all respondents answered every part of the questionnaire; when this was the case the total number of respondents that answered that particular question was recorded. In the first survey, the laboratories were asked about the type of tests offered, the turnaround time of results, the interaction of the laboratory with clinical staff, and the provision of a hospital protocol to help clinical users in the diagnosis of acute coronary syndrome. In the second survey, the 142 respondent laboratories from the first survey were sent a follow-up questionnaire to find out whether there had been any changes in the cardiac markers offered since the first survey. One hundred and seven laboratories (76%) responded to this questionnaire.

Survey 1

Range of tests on offer

The pattern of cardiac markers in use ($n = 142$ laboratories) is displayed in Table 1. One hundred and twenty-nine of all the responding laboratories (91%) offered CK measurement. Seventy-four laboratories (52%) offered profile testing and 68 (48%) offered an individual cardiac marker. Of the 74 laboratories that offered a panel/profile of cardiac markers, 33 (48%) offered troponin as one of the tests. Serum biochemical cardiac markers have been used in the diagnosis of acute coronary syndrome for many years. Some of these markers, such as aspartate aminotransferase, myoglobin, CK and lactate dehydrogenase, are not cardiac-specific. Others have varying degrees of cardiac specificity and their detection in the circulation is dependent on the time of sampling after chest pain and their rate of elimination from the circulation. They include CK-MB (activity or mass measurement), CK isoform ratios, hydroxybutyrate dehydrogenase, troponin I and troponin T.[9] Of the 68 laboratories that offered individual tests for cardiac markers, 53 (78%) offered troponin measurement. No laboratory reported the use of myoglobin or CK-MB isoforms in early diagnosis if the ECG was normal. The use of markers other than troponins for the diagnosis of re-infarction was not investigated in these surveys.

Table 1. *Markers of cardiac damage offered by laboratories in the UK*

Laboratories offering individual tests	48%
Average number of tests per laboratory	2·3
Laboratories offering profile testing	52%
CK, AST (HBD, LDH)	26%
CK, CK-MB (AST, LDH)	26%
CK, CK-MB, troponin (AST, LDH)	16%
CK, troponin (AST, LDH)	32%
Average number of tests per laboratory	3·4

CK = creatine kinase; AST = aspartate aminotransferase; HBD = hydroxybutyrate dehydrogenase; LDH = lactate dehydrogenase.

Turnaround time

The National Academy of Clinical Biochemistry (NACB) recommend a target turnaround time of less than 1 h for the measurement of cardiac markers on a continuous random-access basis. In that document, turnaround time is defined as the time taken from specimen collection to the reporting of results.[5] In our survey 57 (40%) of the responding laboratories offered their tests on a 24-h basis, and 68 laboratories (48%) offered their tests during working hours only (this extended from 08:00 h to 22:00 h for five laboratories). The provision of the troponin service in the 142 respondent laboratories is shown in Fig. 1. For those departments offering batch analysis of troponin, the turnaround time for individual samples can vary, depending on whether the sample arrives before or after the analysis of the batch. Furthermore, in contrast to the NACB document, most laboratories in the UK measure turnaround time from the time the sample arrives in the laboratory to the time the result is available (either by telephone or on ward computer terminals) and not from when the sample is taken. Twenty-nine per cent ($n = 41$) of the laboratories reported a turnaround time of less than 1 h, 39% ($n = 55$) within 2 h and 46% ($n = 65$) within 3 h; however, for 23% ($n = 33$) the turnaround time was longer than 8 h.

Frequency of sampling

In the absence of diagnostic ECG changes, the NACB document recommends the use of up to four samples for the detection of acute MI (on admission, at 2–4 h, at 6–9 h and optional collection at 12–24 h). In this survey, all of the laboratories offering troponin assays had recommendations regarding frequency of sampling. Sixty-two per cent ($n = 88$) recommended between one and three samples, with the second and third samples only being accepted if the first troponin result was negative or equivocal. Seventy-five per cent ($n = 107$) offered advice regarding the appropriate timing of samples for troponin measurement. The

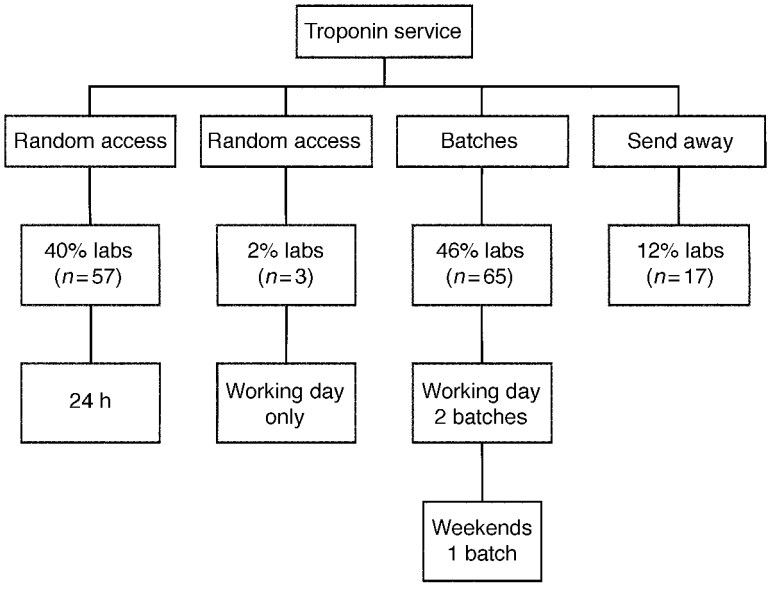

Figure 1. *Provision of a troponin service.*

ESC/ACC consensus document recommends testing on admission, at 6–9 h and again at 12–24 h if earlier samples are negative and clinical suspicion remains high.[7]

Clinical aspects

Forty-four per cent ($n = 62$) of the responding laboratories required consultation by the clinicians before carrying out specific cardiac marker measurements. Fifty-seven laboratories (40%) stated that the clinical information provided on the request form influenced which cardiac markers were offered. However, if no clinical details were provided on the request form, 122 laboratories (86%) would measure the requested cardiac markers, whilst the remaining 20 laboratories (14%) would refuse to perform the tests unless the clinician contacted the laboratory to discuss the clinical requirement. Only 64 laboratories (45%) had a chest pain protocol available for the clinical users and 25 provided their hospital protocols with their responses.

Cardiac markers, especially troponins, in addition to their role in the diagnosis of acute MI, have other useful roles, for example, in the assessment of cardiac perfusion, in risk stratification of unstable angina and in determining prognosis.[5,11–18] The extent of liaison between the laboratory and clinicians for the use of cardiac markers identified in this survey suggests that the laboratory role is usually passive, although a minority of laboratories do have active involvement, particularly in the diagnosis of acute myocardial infarction (*see* Table 2).

Point-of-care testing

Only 17 of the 142 laboratories (12%) provided point-of-care testing for troponin measurement. The remaining laboratories offered central troponin testing only.

Changes to cardiac marker testing

One hundred and twenty laboratories responded to this question, and 74 (62%) reported changes during the last 3 years. Forty-eight laboratories (40%) claimed to offer an adequate cardiac marker service, whereas the remainder felt that their current service was inadequate.

Eighty-four (70%) of the responding laboratories anticipated changes in the near future, even though various barriers would need to be overcome. These included financial constraints in 76 laboratories

Table 2. *Clinical liaison between the clinician and the laboratory for various cardiac conditions*

	Active involvement	No involvement	Not known
Diagnosis of MI ($n = 130$)	30% ($n = 39$)	68% ($n = 88$)	2% ($n = 3$)
Diagnosis of minor MI ($n = 126$)	26% ($n = 33$)	64% ($n = 81$)	10% ($n = 12$)
Risk in unstable angina ($n = 111$)	15% ($n = 17$)	61% ($n = 67$)	24% ($n = 27$)
Assess success of thrombolysis ($n = 100$)	0% ($n = 0$)	44% ($n = 44$)	56% ($n = 56$)
Prediction of ejection volume ($n = 104$)	2% ($n = 2$)	31% ($n = 32$)	67% ($n = 70$)

MI = myocardial infarction.

(63%) and clinical impediments in four (3%); 17 laboratories (14%) cited both financial and clinical constraints.

Survey 2

One hundred and seven replies were received. Fifty-nine (55%) of the responding laboratories that previously had offered an inadequate cardiac marker service had managed to improve their service, by introducing troponin testing and by improving the turnaround time of their troponin assay. Thus, the 93 UK laboratories (87%) that responded now offered troponin measurement (although not all on site). Thirty-seven laboratories (35%) that had judged that they offered an adequate service in survey 1, but also expected change, had improved the turnaround time of their troponin testing service. Of the 48 laboratories (45%) that had judged their service as inadequate in survey 1, and had been unable to change by the second survey, 35 (73%) anticipated a shortened turnaround time in the near future.

Interpretative comments

Sixty-four of the 107 responding laboratories (60%) provided interpretative comments on their cardiac marker reports.

Barriers to change

The barriers to change in survey 2 were very similar to those of survey 1, with financial constraints being the major obstacle for most laboratories. In both surveys (120 replies to this question in survey 1 and 107 in survey 2), 60–65% of the laboratories reported financial barriers to their offering a better troponin service. Less than 7% experienced clinical impediment and 10% of the laboratories had no difficulty in providing troponin testing. The publication of the National Institute for Clinical Excellence document and the business case published by the Association of Clinical Biochemists website should help laboratories in their efforts to fund an appropriate troponin service.[9,19]

Conclusion

The provision of cardiac markers has undergone dramatic changes in the last four years, with most laboratories (nearly 90%) now offering troponin measurement. Many laboratories acknowledge that their turnaround times are inadequate. Most feel that improvements are hampered by financial constraints but are hopeful of improvements in the future.

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