

REGIONAL AUDIT OF CARDIAC MARKERS

North Thames Audit and QA Group,
South Thames Audit Group,
Eastern Region Chemical Pathology Professional
Development Group.

Response to questionnaire:

Total responses = 32

North Thames = 16 (52 %)

South Thames = 9 (30 %)

Eastern Region = 7 (64 %)

Hospital type and size:

DGH = 23 (one covering 3 sites)

All 23 provide A & E services (30,000 – 85,000 attendances per annum (n = 15).

Tertiary / Teaching = 9

8 (88 %) providing A & E (56,400 – 120,000 attendances per annum (n = 5).

Q1. What test do you offer as cardiac markers.

•First Line:

- Troponin I = 14 (44 %)
- Troponin T = 11 (34 %)
- Troponin I or T = 25 (78 %)
- Total CK = 24 (75 %)
- CK-MB mass / activity = 3 (9 %) / 3 (9 %)
- LDH = 3 (9 %)
- AST = 4 (12.5 %)

••Second Line:

- Troponin I = 4 (12.5 %)
- Troponin T = 0
- Total CK = 4 (12.5 %)
- CK-MB mass / activity = 4 (12.5 %) / 1 (3 %)
- LDH = 1 (3 %)
- AST = 1 (3 %)

•POCT:

- Troponin I = 1 (3 %) – as main service to trust.
- Troponin T = 4 (12.5 %)
 - 1 in Chest Pain clinic; 1 as main service to trust;
 - 1 alongside laboratory TnTI; 1 lab use 8pm – 8 am.
- Troponin I / CK-MB mass / Myoglobin = 1 (3 %)
- CK = 1 (3 %)

100 % of responders offer Troponin in some form.

18 laboratories have a written protocol on use of Troponin (1 other in preparation)

One further site has a written protocol prepared by their cardiology department.

The above data was broken down further to examine what combinations of markers are in use.

FIRST LINE	SECOND LINE	POCT	NUMBER
Trop / CK / AST*	---	---	4
TnTI	---	---	3
TnTT / CK	---	---	3
TnTI / CK	---	---	2
TnTI / CK / MB mass	---	---	2
CK	TnTI	---	2
TnTT / CK / MB act	---	---	2
TnTT	CK	---	2
TnTT / CK	CK-MB act	---	1
TnTI / CK	CK-MB act	TnTT	1
TnTI / CK / CK-MB mass / LDH	---	TnTT	1
CK	TnTI / CK-MB	---	1
CK	CK-MB act	TnTI / CK-MB mass / myoglobin	1
CK / CK-MB act	TnTI	---	1
CK / LDH	---	TnTI	1
TnTI	CK	TnTT	1
CK / LDH	CK-MB mass	TnTT	1
TnTT	CK-MB mass	TnTT	1
TnTT	CK-MB mass	---	1
TnTI / CK	TnTT / AST / LDH	---	1
TnTI	CK (re-infarct Only)	---	1

Combinations of cardiac markers offered.

* = Both Troponin T and I users combined.

Q2. How is the service for each marker provided.

All responding laboratories provide enzymes on their main analyser (couple of POCT), and all are available as random access. Availability of Troponin was as follows.

Troponin offered as:

On-demand (urgent) by:

21 users of laboratory based systems. This was only for limited hours in 3 (up to 23:00 or 00:00 or by consultant referral out of hours). In 1 other laboratory, the service was available on Monday – Friday.

3 (possibly 4) users of POCT devices.

In this group, the quoted turnaround time was between 0.2 and 2 hours once the sample is received in the lab. The estimated total turnaround time was 0.2 – 3 hours.

Batched by:

11 laboratories, of which 7 offer Troponin as a frontline investigation.

In this group, the quoted turnaround time was between 1 and 18 hours after receipt of the specimen, with a total turnaround time estimated as between 1.5 and 19 hours.

Amongst those laboratories who provide a service with analyses run as batches, the following services are available.

Troponin offered as	Routine hours	Weekend / on-call
TnTI (first line) / TnTT (POCT)	2 runs per day	2 runs per day
TnTI (first line) / TnTT (clinic)	2 runs per day	1 run per shift
TnTI (second line)	'urgent'	1 run per day
TnTI (first line)	'batched'	Not available
TnTI (second line)	'Available'	Not available
TnTT (first line)	2 hourly (4 runs)	On-call – consultant discussion required Weekend – 2 runs per day
TnTT (first line)	3 runs per day	2 runs per day
TnTI (first line)*	2 runs per day	1 run Sat. Not available Sun
TnTI (second line)	11 am and 4 pm	11 am
TnTI / TnTT	Available	AM only
TnTI (first line)	5 per day	5 per day

For the two sites that have a POCT device the data presented refers only to the laboratory service. * = Troponin is only cardiac marker available, in all other sites the panel of tests available also includes enzymes.

Q3. What analytical system is in use for troponins.

Troponin I

Abbott Axsym = 4

Bayer Immuno = 1

Stratus CS = 2

Beckman Access = 3

Axis Shield Triage = 1

Immolute = 3

Bayer Centaur = 5

Dade Dimension = 1

Troponin T

Elecsys = 7 (both 2010 and 1010)

Modular = 3

Cardiac Reader = 6

Roche (system not stated) = 1

Q4. If known please state the number of assays undertaken per annum.

Data was largely provided only for Troponin. Included with each questionnaire was a request for information on the numbers of patients admitted each year with chest pain, angina or acute MI. This data was provided by 18 laboratories and was used to present the numbers of troponins requested in relation to the numbers of patients presenting.

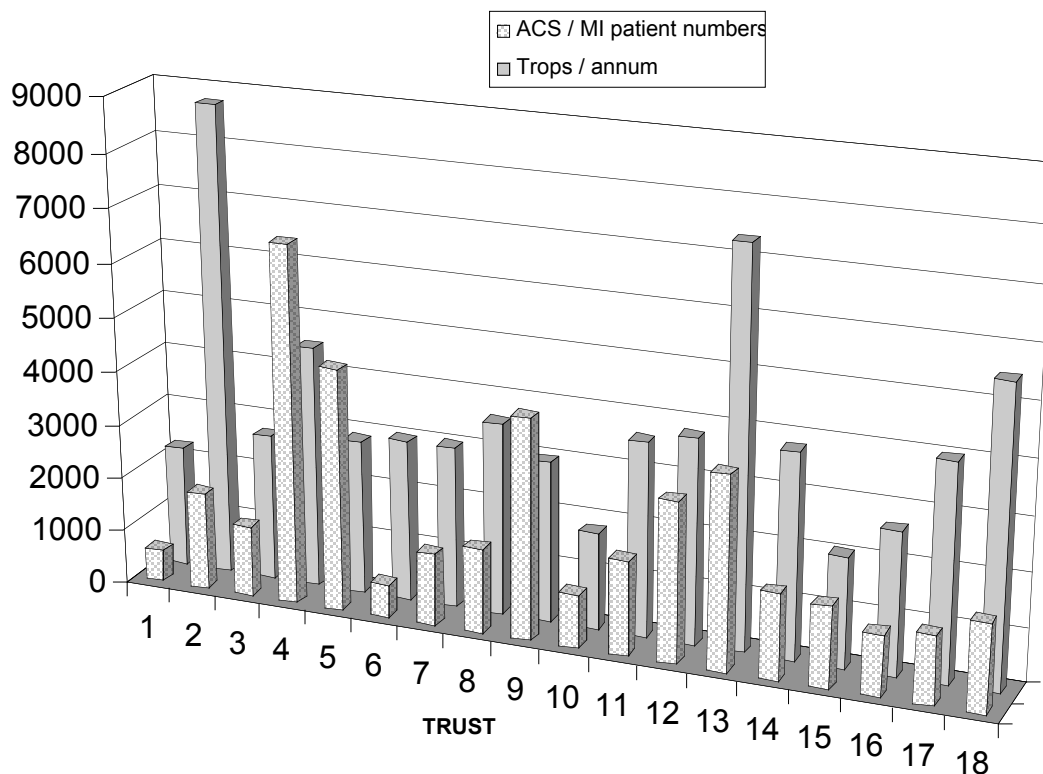


Diagram: Eighteen trusts supplied data for numbers of patient numbers per annum plus numbers of Troponin requests received. The total mean is 3.4 times more troponins than patients (with the exception of two trust), the range being up to 7.3 fold. All trusts have a protocol suggesting one sample per patient.

Q5. For each marker, please state if you participate in a recognised EQA scheme, and what that scheme is.

Marker	NEQAS	WEQAS	SEQAS	Randox	RIQAS	NONE	No Reply
CK (n = 42)*	57 %	33 %	---	5 %	---	2.5 % POCT	2.5 %
CK-MB (n = 15)*	26 %	20 %	7 %	20 %	7 %	7 % POCT	13 %
LDH (n = 5)*	50 %	25 %	---	25 %	---	---	---
AST (n = 6)*	50 %	33 %	---	17 %	---	---	---
Troponin (n = 34)	12 %	15 %	44 %	9 %	---	15 % 3 POCT 2 lab	5 %

For each marker, the total number of replies seems higher than the total numbers of returns or users. This is because each individual analytical system has been counted. Also, for enzymes, 10 laboratories have registered with more than one scheme.

Q6. According to your protocol, how many Troponin measurements are made in each patient.

5 laboratories have no protocol.

21 laboratories have a protocol recommending one measurement.

4 laboratories have a protocol recommending two measurements.

2 laboratories have a protocol recommending 3 measurements.

Of the 21 labs recommending one measurement:

13 labs suggest 12 hours or greater (6 = TnTI; 6 = TnTT; 1 = both).

1 lab suggests 4 - 6 hours (TnTT).

1 lab suggests > 6 hours (TnTT).

1 lab suggests 8 – 12 hours (TnTI).

1 lab suggests > 10 hours (TnTI).

1 lab suggests 18 hours (TnTI).

2 labs not stated.

Of the 4 labs recommending two measurements:

3 suggest 0 (admission) and 12 hours (2 x TnTI; 1 x TnTT).

1 suggests 6 hours and 6 hours after the first (TnTI).

Of the two labs recommending 3 measurements:

1 lab suggests 0, 6 and 12 – 24 hours.

1 lab suggests 0, 4 – 6 and 12 hours.

One lab protocol states that the samples should be timed from the point of admission, all others after the on-set of symptoms, but three labs do have the proviso that the history should be reliable. One lab stated that either the time of admission or on-set of symptoms could be used.

Q7. In addition to cardiac troponins, does your trust provide cardiac enzymes on the same patient.

25 of 32 provide enzymes in addition to Troponin, and of these 25, 14 are serial measurements.

Of the 14 labs offering serial enzyme measurements, 6 have a protocol:

Four labs stated once a day for three days.

One lab stated two measurements.

One lab stated same as Troponin (this was one of the labs recommending three Troponin measurements).

When a negative Troponin result is obtained, 10 laboratories have a protocol suggesting a repeat sample be taken as follows:

5 labs repeat after 12 hours (1 only if chest pain recurs).

1 lab repeats equivocal Troponin T.

1 lab repeats at > 6hours after the first.

1 repeats only if the first was incorrectly timed and there is still strong indication.

2 labs not stated.

Q8. What biochemical marker(s) do you use / recommend for the investigation of re-infarction.

30 labs have recommendations for the investigation of re-infarction:

Total CK is suggested by 11:

10 of these offer no guidance.

1 lab suggests only if > 48 hours from previous infarct.

Total CK plus CK-MB is suggested by 5:

All 5 offer no guidance on use.

CK-MB was suggested by 1 laboratory.

This was offered only after 'case by case' discussion.

Troponin was suggested by 6 labs:

1 lab suggested to sample immediately then repeat after a further 12 hours.

4 labs offered no guidance.

1 lab required discussion with lab consultant.

Troponin plus enzyme was suggested by 7 labs:

1 suggested TnTT after 1 week from previous event and CK after 4 days.

1 suggested TnTT 5 days after previous event, with no guidance for CK.

3 suggest Troponin plus CK but offer no guidance.

1 suggest TnTI plus CK after 'case by case' discussion.

1 suggests TnTT, CK and CK-MB with no guidance offered.

Q9. For the Troponin method used within your trust, what is your quoted upper reference limit.

For this question, only responses from laboratories whose method had more than one user were collated.

For **Troponin I**, the method related upper reference limits were:

Beckman Access:- 2 labs = 0.04 µg/L; 1 lab = 0.03 (Access 2).

Source: 2 = manufacturer; 1 = not stated.

Abbott AxSYM:- 1 = 0.3 µg/L; 1 = 0.6 µg/L; 1 = < 0.4 µg/L; 1 = 0.5 µg/L

Source: All four labs replied that data was from the manufacturer.

Bayer Centaur:- 2 labs = 0.2 µg/L; 2 labs = 0.1 µg/L; 1 lab = not stated

Source: 3 = not stated; 1 = manufacturer.

Immulite:- 1 lab = not stated; 1 lab = 2.0 ng/ml; 1 lab = < 0.2 ng/ml.

Source: 1 = manufacturer; 1 = not stated; 1 = 50 OPD patients.

Stratus CS:- 1 lab = < 0.06 µg/L; 1 lab = 0.06 µg/L

Source: 1 = not stated; 1 = manufacturer.

RECOMMENDED GUIDELINES FOR CARDIAC MARKERS.

- 1) All users should have a cardiac marker protocol for their laboratory and point of care testing. The laboratory should educate all users on a regular basis.
- 2) The service provided should be optimised after discussions with the users. There is need for a minimum service of daily Troponins available 7 days a week. The service details should be made available to all users.
- 3) Cardiac markers offered should be restricted to Troponin T or Troponin I, plus the enzymes CK and CKMB if required locally. The time of chest pain and blood collection should be documented to aid interpretation of the results.
- 4) The cut-off level quoted for risk stratification should be determined by the laboratory for their current method and should have a CV of 10 % or less¹. The source of the cut off should be known and the cut-off should be reported with every result.
- 5) Only one Troponin should be requested on each patient if collected at 12 hours post chest pain. Second request should be discussed with staff in the Biochemistry Department. If the Troponin is negative but the sample was collected before 12 hours, it should be repeated at 12 hours or greater, and before the patient is discharged.
- 6) The Point of care method and laboratory method should use the same marker in the same Trust i.e. either Troponin T or Troponin I
- 7) All systems, including laboratory methods and Point of Care should be Quality Assured.
- 8) If the test is done as Point of Care all POCT Guidelines for CPA and MDA should be followed. No equipment should be purchased without agreement of the Trust POCT committee or Biochemistry Department.

9) Laboratories should be aware of interferences in laboratory and POCT methods e.g. haemolysis and heterophilic antibodies.

Reference:

1. Myocardial infarction re-defined. A consensus document of the joint European Society of Cardiology / American College of Cardiology Committee for the re-definition of myocardial infarction. *J Am Coll Cardiol* (2000), **36** (3), 959 – 69.

SUMMARY OF DISCUSSION AT CARDIAC MARKER AUDIT

Are Troponin levels needed more than once? No, NOT if done at 12 hours. If they are done too early the patient needs to be kept in and troponin repeated at 12 hours. If they are done early and are positive the patient will still be managed the same way. If positive, the result will not be acted on for 1 or 2 days if clinicians are not sure what is going on and it will not affect immediate management

Cardiology and A and E should know when the lab runs the assays if batched analysis is offered

Troponins are not required urgently or out of hours. Fluctuations (dynamic changes) in the ECG and clinical symptoms should be used. The standard treatment is medical until they are sent to the Cardiac catheter lab. It is recommended to do cardiac catheterisation and angioplasty within 3 days of the event. Troponins should be done on a daily basis.

The service may be useful at night for rule out, not for rule in. If the patient has a negative ECG which stays normal the risk of ACS is low.

Troponins become useful if the patient has hypertensive heart disease, previous CABG with chest pain but these patients need to be kept in with Troponin measured at an appropriate and safe time until other tests are arranged.

If the Troponin T is elevated at 12 hours treatment is started immediately. A high risk patient with chest pain and normal ECG is started on aspirin, low molecular weight heparin, GTN and kept in for observation and a Troponin T at 12 hours. If the Trop is elevated therapy is maintained. If only the Trop is elevated a treadmill test is organised then a cardiac catheter.

Troponin is not useful in A and E as there is not a high index of suspicion. If they are worried patients will be willing to stay for 12 hours

Thrombolysis increases the risk of strokes and causes more harm than good.
It is only useful in full thickness infarct.

?Myoglobin as a rule out marker in Troponin negative patients taken at less than 6 hours. The sensitivity of myoglobin is 75-85 %

With Troponins 75-80 % are picked up at 6 hours. It is dangerous to discharge patients with negative troponins before 12 hours.

People comply with the 4 hour wait in A and E by moving these patients to a separate ward.

Should labs still be offering AST, LDH and SHBD

Troponin T is elevated for more than 7 days, Troponin I is elevated up to 4 days.

Haemolysis interferes with Troponin T, does it interfere in Troponin I

Interfering factors with Troponins due to heterophilic antibodies and increases in renal failure.