

## Revised national guidelines for analysis of cerebrospinal fluid for bilirubin in suspected subarachnoid haemorrhage<sup>†</sup>

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### Abstract

It is crucially important to detect subarachnoid haemorrhage (SAH) in all patients in whom it has occurred to select patients for angiography and preventative surgery. A computerized tomography (CT) scan is positive in up to 98% of patients with SAH presenting within 12 h, but is positive in only 50% of those presenting within one week. Cerebrospinal fluid (CSF) bilirubin spectrophotometry can be used to determine the need for angiography in those few CT-negative patients in whom clinical suspicion of SAH remains high; it may remain positive up to two weeks after the event. A lumbar puncture (LP) should only be performed >12 h after the onset of presenting symptoms. Whenever possible collect sequential specimens. Always ensure that the *least blood-stained* CSF sample taken (usually the last) is sent for bilirubin analysis. Protect the CSF from light and avoid vacuum tube transport systems, if possible. Always use spectrophotometry in preference to visual inspection. All CSF specimens are precious and should always be analysed unless insufficient sample is received. Centrifuge the specimen at >2000 rpm for 5 min as soon as possible after receipt in the laboratory. Store the supernatant at 4°C in the dark until analysis. An increase in CSF bilirubin is the key finding, which supports the occurrence of SAH but is not specific for this. In most positive cases, bilirubin will occur with oxyhaemoglobin.

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### Introduction

Subarachnoid haemorrhage (SAH) is spontaneous arterial bleeding into the subarachnoid space, usually from a cerebral aneurysm.<sup>1</sup> Patients who have bled and in whom the diagnosis is initially missed often present with a further bleed, in a poorer condition and with a worse outcome than those in whom the correct diagnosis is made promptly.<sup>2,3</sup> It is thus crucially important to detect SAH in all patients in whom it has occurred.

The initial investigation – the demonstration of blood on a computed tomography (CT) scan – will, in experienced hands, be positive in 98% of patients with SAH presenting within the first 12 h after an event,<sup>4</sup> but positivity falls with time to about 50% in patients presenting after one week.<sup>5</sup> Patients with a positive CT usually proceed to angiography, a resource-intensive procedure, to confirm the

presence of an aneurysm and locate its site so that it can be treated to prevent a re-bleed. There is a need for a procedure for detecting those CT-negative patients presenting with a history suggestive of SAH who actually have sustained SAH,<sup>4</sup> and to eliminate the possibility of SAH in the remainder without the need for angiography. Best estimates are that a UK hospital may see up to 150 patients per annum with symptoms of SAH who are CT-negative; some 2–3% of these will be proven to have a ruptured aneurysm.<sup>4</sup>

Following haemorrhage into the CSF, red blood cells undergo lysis and phagocytosis; the liberated oxyhaemoglobin is converted *in vivo* in a time-dependent manner into bilirubin,<sup>6</sup> and sometimes methaemoglobin.<sup>7</sup> Of these three pigments, only bilirubin arises solely from *in vivo* conversion. However, CSF bilirubin will also be increased when CSF total protein or serum bilirubin is increased.

Oxyhaemoglobin and methaemoglobin may both be produced *in vitro* as well as *in vivo*.<sup>8</sup>

Bilirubin may be detected in CSF by spectrophotometry or by visual inspection for the yellow discoloration (xanthochromia) it imparts to CSF. Evidence clearly indicates that visual inspection is not a reliable method.<sup>9,10</sup> Analysis of bilirubin in CSF using diazo methods has not been adequately validated and should not be used.

We now propose revised guidelines for the specimen requirements, transport, handling and analysis of CSF and interpretation in suspected SAH with a negative CT scan. Notes to these guidelines, printed as Appendix 1, provide the reasoning behind our recommendations.

## Specimen requirements and transport

A protocol for specimen requirements and transport is provided in Appendix 1, although modification may be required to meet local needs. Essentially, the requirements are:

- CSF samples should ALWAYS be analysed if sufficient sample is received.
- The specimen for spectrophotometry should be the least blood-stained fraction of CSF to be taken (usually the last and ideally at least the fourth [Note a]).
- The volume requested must be that which enables the analysis to be undertaken without dilution (Note b), and will be determined by local requirements.
- The specimen should be protected from light (Note c).
- Use of pneumatic tube systems to transport the specimen to the laboratory is best avoided,<sup>11</sup> but the overriding consideration is rapid transport of the sample to the laboratory (Note a).
- A simultaneous blood specimen should be taken for serum bilirubin and total protein measurement.
- The timing of sampling relative to that of possible haemorrhage should be recorded. This should be no less than 12 h (Note d).

It is advised that prospective protocols are discussed with users of the service.

## Specimen handling

The specimen designated for spectrophotometry should be centrifuged at >2000 rpm for 5 min as soon as possible after receipt in the laboratory and in any case within 1 h of collection. The supernatant should be stored in the dark at 4°C until analysis (Note c).

## Analysis

- Perform a zero-order spectrophotometric scan on the supernatant between 350 and 600 nm using a recording spectrophotometer and a cuvette with a 1 cm path length. Use an initial full-scale deflection (FSD) of 0.1 absorbance units (AU). If any peaks exceed 0.1 AU, scale as appropriate but never use an FSD < 0.1 AU (Note e).
- The specimen should not be diluted.

Inspect the scan and identify and record the presence of the following haem pigments:

- *Oxyhaemoglobin*: absorbance maximum between 410 and 418 nm.
- *Bilirubin*: either a broad peak in the range 450–460 nm or a shoulder adjacent to an oxyhaemoglobin peak if present.
- *Methaemoglobin*: the rarest pigment and if present usually manifests as a broader peak than oxyhaemoglobin, occurring between 403 and 410 nm.

Calculate the net bilirubin absorbance (NBA) according to Chalmers' modification<sup>12</sup> to the original method of Chalmers and Kiley<sup>13</sup> as follows (Note f):

- Draw a predicted baseline, which forms a tangent to the scan between 350 and 400 nm and again between 430 and 530 nm. This baseline should never cut the scan.
- Measure the absorbance of the scan above this predicted baseline at 476 nm; this is the NBA. If the baseline forms a tangent to the scan before 476 nm, then the measured NBA is by definition zero.
- Also measure the absorbance of any oxyhaemoglobin peak above this predicted baseline; this is the net oxyhaemoglobin absorbance (NOA).

Illustrative zero-order spectra are shown in Figures 1a–e.

## Reporting and interpretation

The following is the most appropriate advice that we can provide regarding reporting and suggested interpretative comments. For each case, the final interpretation should take into account the available clinical information and the known dynamic production of haem pigments following a bleed as outlined in the Introduction. Following SAH, the appearance of the CSF may be bloodstained and the CSF protein may be raised. Bilirubin is the key spectrophotometric finding. Most positive cases exhibit both bilirubin and oxyhaemoglobin. Bilirubin occurring on its own would not be expected within the first few days, but becomes an increasingly possible finding as the second week progresses.

$$\text{NBA} \leq 0.007 \text{ AU and NOA} \leq 0.02 \text{ AU}$$

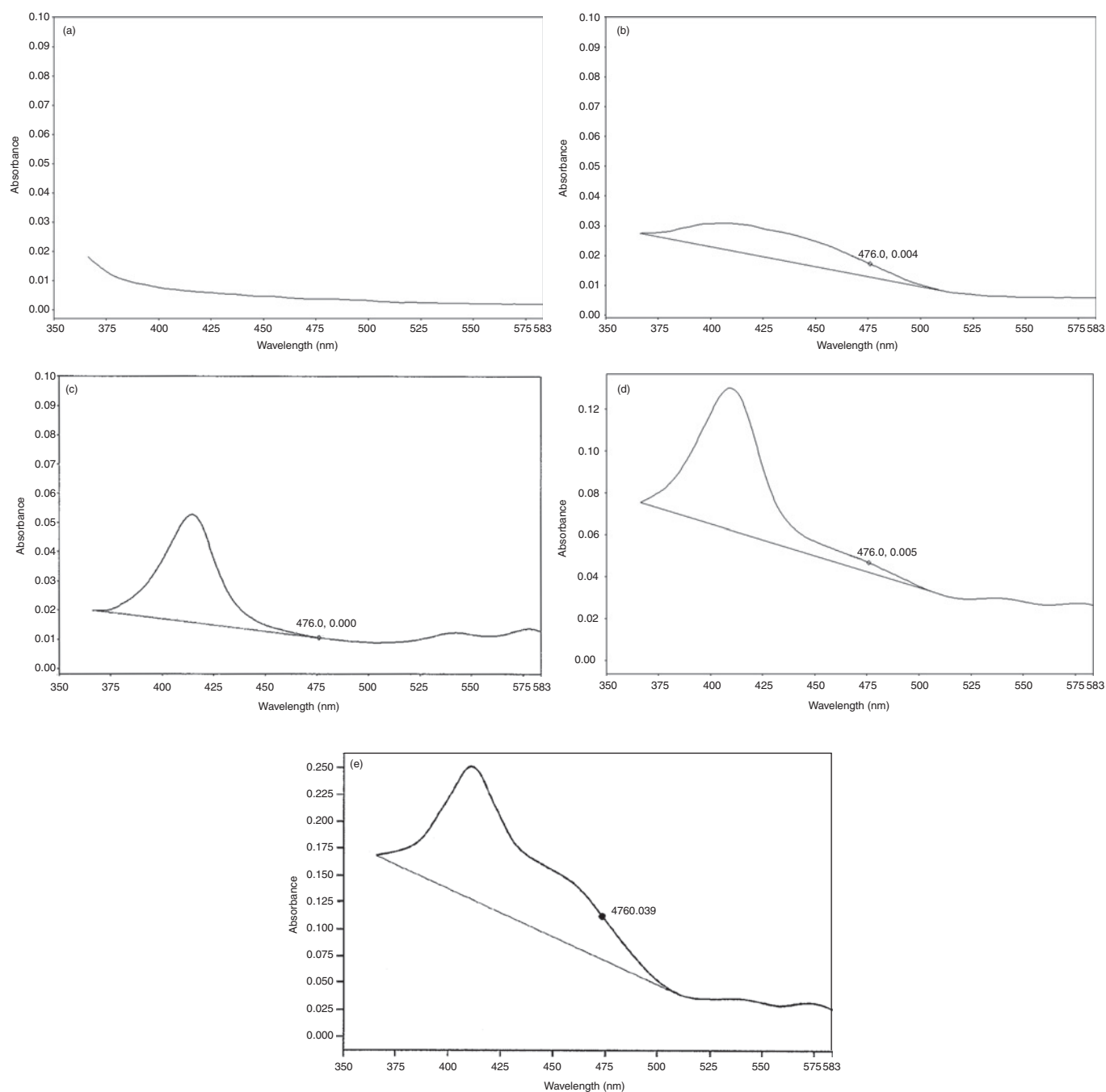
Report as: 'Bilirubin and oxyhaemoglobin not increased. No evidence to support SAH.'

$$\text{NBA} \leq 0.007 \text{ AU and NOA} > 0.02 \text{ AU but} < 0.1 \text{ AU}$$

Report as: 'Bilirubin not increased. Small amount of oxyhaemoglobin detected. No evidence to support SAH.'

$$\text{NBA} \leq 0.007 \text{ AU and NOA} \geq 0.1 \text{ AU}$$

Report as: 'Oxyhaemoglobin is present in sufficient concentration to impair the ability to detect bilirubin. SAH not excluded.'



**Figure 1(a–e)** Representative spectrophotometric scans showing net bilirubin absorbance (NBA) at 476 nm above a tangential baseline as described in the text. 1(a) A normal cerebrospinal fluid with essentially no bilirubin; scan and baseline (not drawn) are superimposable. 1(b) NBA within the reference range. 1(c) Oxyhaemoglobin with zero NBA. 1(d) Oxyhaemoglobin with NBA within the reference range. 1(e) Oxyhaemoglobin with an increased NBA. In practice, such scans are best visualized filling the whole of an A4 page in landscape mode

NBA > 0.007 AU and NOA ≤ 0.02 AU or NOA > 0.02 AU but with no visible oxyhaemoglobin peak

(a) Serum bilirubin ≤ 20 μmol/L and CSF protein ≤ 1.0 g/L.

Report as: 'Increased CSF bilirubin. Consistent with SAH.' (This would be an unusual pattern within the first week after an event.)

(b) Serum bilirubin > 20 μmol/L and CSF protein ≤ 1.0 g/L.

Apply formula to calculate an adjusted NBA (Appendix 2).

If adjusted NBA > 0.007 AU

then report as: 'Increased CSF bilirubin. Consistent with SAH.' (This would be an unusual pattern within the first week after an event.)

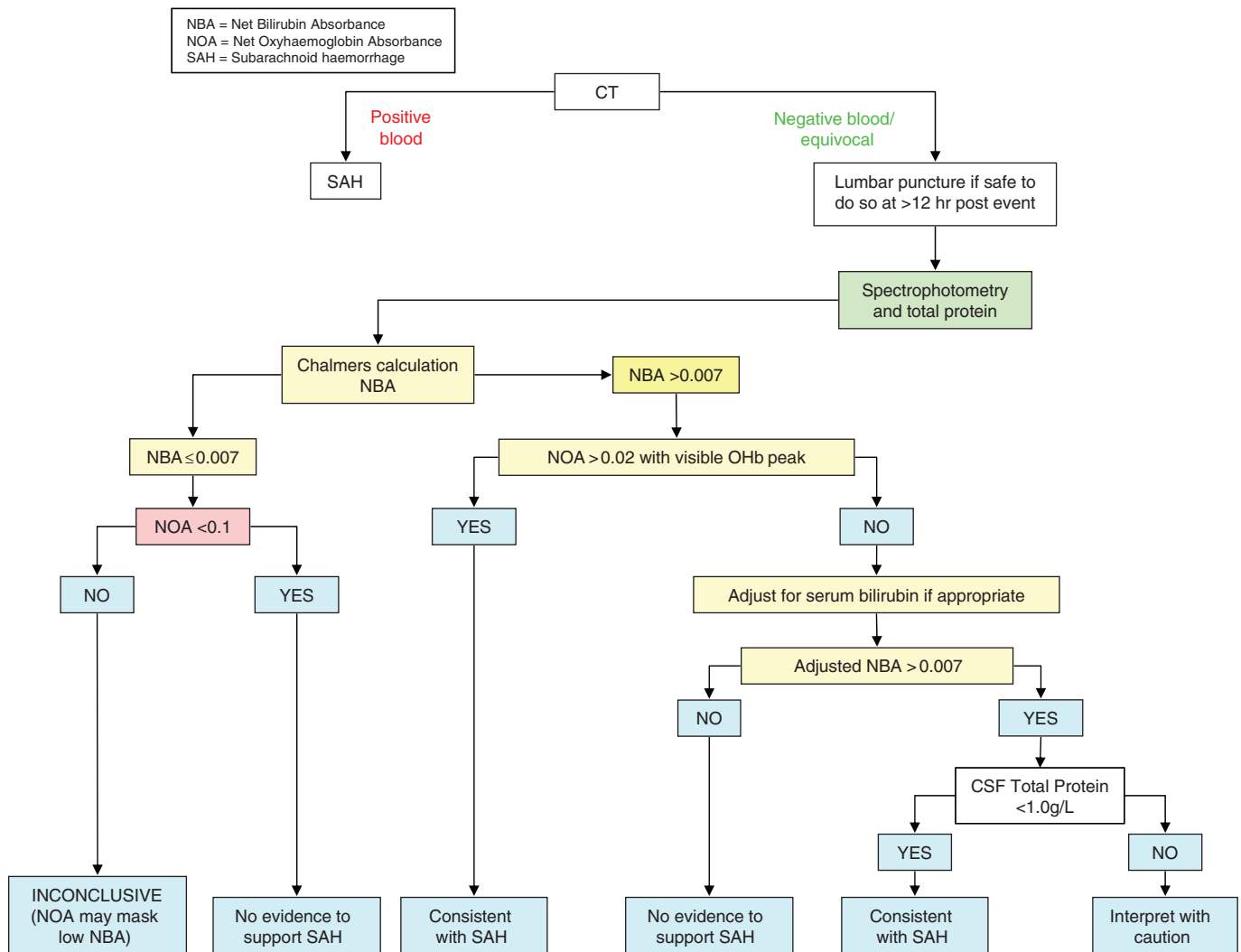


Figure 2 Bilirubin absorbance in cerebrospinal fluid for detection of intra-cranial bleed

If adjusted NBA  $\leq 0.007$  AU

then report as: 'Increased CSF bilirubin but probably totally accounted for by increase in serum bilirubin. Not supportive of SAH.'

(c) CSF protein  $>1.0$  g/L, whatever the serum bilirubin.

Report as: 'Increased CSF bilirubin. This finding may be consistent with: SAH; an increased bilirubin accompanying the increased CSF protein; or other source of CSF blood. Interpret result with caution in relation to SAH especially if within first week of event.'

NBA  $>0.007$  AU and NOA  $>0.02$  AU with visible oxyhaemoglobin peak

Report as 'Bilirubin and oxyhaemoglobin increased. Consistent with SAH'

### Methaemoglobin detected

This is an unusual finding and probably related to artefactual conversion of oxyhaemoglobin (Note k). Therefore, when methaemoglobin is present, the significance of the finding is the same as if oxyhaemoglobin had been detected.

### Decision tree

A decision tree (Figure 2) outlines the steps involved in producing the key laboratory information for the detection of a subarachnoid bleed.

### Standards based on these guidelines

- (1) The laboratory should provide instructions for users which provide details of requesting, specimen requirements, transport and interpretation (see example in Appendix 1).
- (2) There should be standard operating procedures (SOPs) in place for specimen handling, analysis, reporting and interpretation.

- (3) The laboratory must participate in an appropriate external quality assurance scheme.
- (4) It is unlikely that a laboratory will build up sufficient expertise unless a minimum of 25 specimens are analysed annually.
- (5) The nature of the analytical service that a laboratory provides, e.g. whether it is available only within certain hours or at all times, will be dependent upon local needs. In particular, these will be determined by the tertiary centre's referral policy, access to its beds and availability of angiography. Both the analytical and interpretative aspects of the service should be provided together.
- (6) To meet the requirements of clinical governance all spectrophotometric scans should be kept in an appropriate form for recall for a minimum of two years.
- (7) Spectrophotometers should be serviced regularly and undergo regular absorption and wavelength checks.

## Notes to the guidelines

- (a) In addition to the oxyhaemoglobin which appears after a SAH, it also commonly arises either from the *in vitro* lysis of red cells in the CSF obtained following puncture, or from the trauma of the puncture itself. As explained in note (g) below, such oxyhaemoglobin may interfere with the detection of bilirubin and is a confounding element in interpretation. Therefore every effort should be made to eliminate it. It is for this reason that CSF taken for spectrophotometry should be collected into a separate container to those in which the first few mL of fluid are placed, and why transport by pneumatic tube is not recommended.
- (b) As explained in note (j) even small increases above the reference range are sufficient to be consistent with a SAH and therefore indicate the need for angiography. Dilution of the specimen will decrease the certainty with which such increases may be detected.
- (c) Stability studies have shown that CSF stored in a plastic tube and exposed to spring daylight through a north-facing window showed a bilirubin decay rate of at least 0.005 AU/h. CSF specimens must therefore be protected from light to avoid this phenomenon, which may lead to false-negative results.
- (d) Current consensus is that CSF should not be examined for bilirubin earlier than 12 h after an event. This is based on two strands of evidence.
  - (1) That bilirubin forms 9–15 h after a bleed.<sup>6,14</sup> We have been unable to review the evidence on which this statement has been made.
  - (2) That in a series of 111 patients positive for blood on CT, all subject to LP after 12 h, xanthochromia was present in all.<sup>15</sup> This evidence must be reviewed with caution due to the ambiguous definition of xanthochromia.

It is also commonly believed that xanthochromia will be evident in all patients up to two weeks following a bleed. Again this is based on an inappropriate group, those who were positive for blood on CT.<sup>15</sup> In patients who are negative for blood on CT who may be negative due to late presentation or small bleeds, we cannot be certain about this period of two weeks. In our experience, we have detected an increased CSF bilirubin in two patients subsequently shown to have ruptured aneurysms where the CSF was taken at 11 and 14 days after the onset of symptoms.
- (e) Derivative spectroscopy has been found to be of value by some analysts, but requires considerable experience in interpretation. It is therefore not recommended.
- (f) We have confirmed that, on 58 CSF specimens with bilirubin NBA 0.003–0.251 (24 of which contained oxyhaemoglobin in addition to bilirubin), there was no significant difference between the NBA obtained by the original Chalmers and Kiley method<sup>13</sup> and that by the modification of Chalmers.<sup>12</sup>
- (g) Out of 740 spectrophotometric scans reviewed from CT-negative patients in four participating centres, 425 had no oxyhaemoglobin and  $\leq 0.007$ . Angiograms were performed in 31 of these 425 patients and no aneurysms were found.
- (h) From the same series, 204 CSFs were reported as containing oxyhaemoglobin with NBA  $\leq 0.007$ . Twenty-nine of these patients had angiography. In only two instances was an aneurysm found and in one of these the NOA was  $>0.1$  AU.
- (i) Experiments using a combination of increasing bilirubin and oxyhaemoglobin concentrations have indicated that at an NOA of  $>0.1$  AU there begins to be an under recording of NBA.
- (j) Originally, Chalmers and Kiley<sup>13</sup> indicated a reference range for NBA of 0–0.007; values 0.010–0.015 were classed as equivocal and values  $>0.015$  as positive. In the series quoted above, CSFs from three patients with proven ruptured aneurysms have yielded NBA of 0.008, 0.015 and 0.016. In addition, we are aware of three CT-positive patients with proven aneurysms where the CSFs have yielded NBA of 0.008, 0.012 and 0.019. We therefore recommend that values of a NBA  $> 0.007$  are a clear indication for angiography. In the series quoted above, 27 patients with NBA  $> 0.007$  proceeded to angiography of which 12 were found to have aneurysms.
- (k) While there is documented evidence for the production of methaemoglobin following SAH, it was such an uncommon finding in the series quoted (in four patients, one of whom was angiography positive) that no clear indication of its significance could be obtained. Very recent work, which needs to be confirmed, has implicated high concentrations of iodine (widely used as a skin disinfectant) as being involved in *in vitro* methaemoglobin formation.

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and the contributions of former members M Fahie-Wilson, PR Wenham, P Thomas and K Allen.

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## Appendix 1

### Exemplar protocol for the collection, handling and transport to the laboratory of cerebrospinal fluid requiring spectrophotometric scanning for the detection of bilirubin

#### Principle

This test is performed to try to identify those patients who have had a SAH but in whom the CT scan is negative. The spectrophotometric scan detects bilirubin in CSF and this finding is consistent with a bleed into the CSF.

The formation of bilirubin after haemorrhage is a time-dependent process and bilirubin may not be detectable soon after the event (e.g. onset of severe headache). On current evidence, it is recommended that CSF is not sampled until at least 12 h after a suspected event. The opening pressure should always be recorded when performing a LP. LP is contraindicated in patients with papilloedema, focal neurological deficit or reduced consciousness.

Please indicate on the request form:

- Clinical indication for request.
- Result of CT scan.
- Time of onset of symptoms/event.
- Time of LP.
- If the differential diagnosis includes meningitis.

#### Specimens

- CSF may also be required for microbiological examination and for protein and glucose estimation. Sufficient

CSF will therefore be needed for all of these required investigations.

- Label three 28 mL sterile universal containers and *one yellow-top fluoride EDTA tube* each with the patient's name, hospital number, ward, date of birth, time that the CSF was obtained and the sequence order of sampling.
- The first specimen should be a *minimum of 0.5 mL* of CSF placed in a *yellow-top fluoride EDTA tube* for *glucose* and *protein* estimations. This specimen should be sent to *Clinical Biochemistry*.
- *Microbiology* requires *at least 5 mL* of CSF divided into *two* sequentially numbered sterile 28 mL universal containers labelled 'second' and 'third'. These two specimens must be delivered to the *Microbiology* Department as soon as possible. *Use of the pneumatic tube delivery system should be avoided*.
- A further minimum of 1 mL of CSF should be placed in the final (labelled 'fourth') sterile 28 mL universal container for the spectrophotometric scan. (NB 1 mL is about 20 drops from the Luer connector on a needle). Protect this sample from the light by placing it in a thick brown envelope outside the usual plastic specimen bag.

A blood specimen should be taken at the same time for serum bilirubin, total protein and glucose estimation that are needed to aid interpretation.

These samples must also be delivered to the *Clinical Biochemistry* Department as soon as possible. Use of the pneumatic tube delivery system is best avoided.

If this procedure is not followed analysis is likely to be compromised.

Text in *italics* indicates those details subject to local requirements.

## Appendix 2

### Adjustment of net bilirubin absorbance for an increase in serum bilirubin

The predicted absorbance (PA) of a CSF at 476 nm due to bilirubin can be calculated according to the equation.<sup>16–18</sup>

$$PA = \frac{\text{CSF total protein (g/L)}}{\text{Serum total protein (g/L)}} \quad (1)$$

$$\times \text{Serum bilirubin } \mu\text{mol/L} \times 0.042\text{AU}$$

$$\text{Then adjusted NBA} = \text{measured NBA} - PA \quad (2)$$

We recommend use of this formula because it has been validated for use:

- (1) In neonatal jaundice,<sup>19</sup> albeit often at higher bilirubins than are encountered in adults;
- (2) In a group of 12 patients with increased serum bilirubin and CSF protein up to 1.0 g/L where predicted – actual NBA produced a mean value of – 0.002 AU.

We do not recommend it for use where the CSF bilirubin is increased due to an increased CSF protein alone, or where there is an increased serum bilirubin and the CSF protein is greater than 1.0 g/L, because of lack of validation.

For further information please refer to recently published correspondence.<sup>20</sup>

# Abstracts from the ACB National Meeting

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| 1 | The future of laboratory medicine<br><i>J M B Hicks, Washington DC, USA</i>  | 2 | Saving children's lives by expanded newborn screening for metabolic diseases using tandem mass spectrometry<br><i>M Bennett, Philadelphia, USA</i> |
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| 1 | The standardisation of thyroid function tests<br><i>L M Thienpont, Ghent, Belgium</i>  | 3 | Laboratory medicine in the information age: reflections on the future<br><i>R Jones, Leeds</i>   |
| 2 | Identification of peptidases degrading B-type natriuretic peptide: start of a new therapeutic strategy<br><i>T Walther, Hull</i> |   |  |

## Symposia

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| 5 | The application of genetics to our understanding of ovarian cancer<br><i>H Russell, Belfast</i>      | 8  | Non-alcoholic steato-hepatitis<br><i>C Day, Newcastle Upon Tyne</i>   |
| 5 | Proteomic approaches to cancer biomarker discovery and validation<br><i>A Martin, Birmingham</i>     | 8  | Autoimmune liver disease: next steps in the diagnostic laboratory<br><i>E T Davies, London</i>  |
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| 6 | Testosterone and the metabolic syndrome<br><i>K S Channer, Sheffield</i>                             | 9  | Insulinoma and gastrinoma: diagnostic challenges in neuroendocrine tumours<br><i>B Eriksson, Uppsala, Sweden</i>  |
| 7 | Androgen abuse in sport<br><i>M Wheeler, Exmouth</i>   | 10 | Genetic basis of neuroendocrine tumours<br><i>R V Thakker, Oxford</i>   |
| 7 | National audit of the short synacthen test<br><i>J Middle, Birmingham and K Chatha, Coventry</i>     | 10 | Quantitative mass spectrometry of small molecules<br><i>S Rainbow, Harrow</i>   |
| 7 | Audit of Point of Care Testing infrastructure within UK NHS laboratories<br><i>A Thomas, Cardiff</i> | 11 | New mass spectrometric strategies for the qualitative and quantitative analyses of proteins<br><i>S J Gaskell, Manchester</i>   |



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- 21 Clinical applications of proteomics  
*A D Whetton, Manchester*
- 21 Quality assurance in molecular diagnostics  
*M Pazzagli, Florence, Italy*
- 22 Metabolomics: opportunities and challenges  
*M Gibney, Dublin, Ireland*
- 22 Quality assurance: the ongoing quest  
*J C Boyd, Charlottesville, USA*

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| <p>23 Quality issues with POCT<br/><i>A Thomas, Cardiff</i></p> <p>23 Quality in healthcare and the human factor: lessons from the aviation industry<br/><i>M Bromiley, London</i></p> <p>23 Cystic fibrosis: sweat, blood and years<br/><i>J S Elborn, Belfast</i></p> | <p>23 Dyslipidaemia in childhood<br/><i>P Durrington, Manchester</i></p> <p>24 Prevention of hyponatraemic deaths in paediatric practice<br/><i>S Playfor, Manchester</i></p> |
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### Siemens Award Competition

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| <p>25 Fetuin-A and arterial stiffness in a cohort of chronic kidney disease patients<br/><i>E R Smith, Brighton</i></p> <p>25 Testing compliance/absorption/metabolism of prednisolone in severe asthmatic patients<br/><i>J E Heynes, Birmingham</i></p> <p>25 Development and comparison of assays for the investigation of CYP2D6 variants<br/><i>M Barr, Glasgow</i></p> <p>26 The prognostic utility of B-type natriuretic peptide in patients undergoing cardiac surgery<br/><i>J McNeilly, Aberdeen</i></p> | <p>26 The utility of cystatin C in the immediate post-liver transplant period in children<br/><i>E Okokon, London</i></p> <p>26 An improved assay for the measurement of pancreatic faecal elastase-1 using a novel dry faecal collection device<br/><i>P Kampanis, Birmingham</i></p> |
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### Posters to be displayed on Tuesday, Wednesday and Thursday

#### Siemens Poster Prize

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| <p>28 Three cases of congenital adrenal hypoplasia with novel mutations in the (NROB1) DAX-1 gene<br/><i>C M Florkowski, B Wheeler, P Hunt, K McKenzie, H C Potter, P M George, Christchurch, New Zealand</i></p> <p>28 Oh MI goodness? Markedly elevated troponin I in a 13 year old female<br/><i>J Vernazza, S Barnes, London</i></p> <p>28 Biochemical investigation of abnormal electrolytes in a neonate<br/><i>B Tennant, T Rangarajan, D Cassidy, J Geen, Merthyr Tydfil</i></p> | <p>29 A rare case of polyclonal Mu Heavy Chain Disease<br/><i>J Forsyth, S Mayne, N Lawson, Derby</i></p> <p>29 A mysterious case of hypoglycaemia<br/><i>C Dibden, J Elliott, F M Creagh, A D R Mackie, A Blumsohn, Sheffield</i></p> <p>29 A noble man<br/><i>S M E Oxford, S Rainbow, D Wright, M Jacyna, Harrow</i></p> |
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### Posters to be displayed on Tuesday

#### Immunology

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| <p>31 Prevalence of HIV infection in rural South Africa<br/><i>A J Groenewald, H J van Wyk, C M Walsh, Bloemfontein, South Africa</i></p> <p>31 Allergy: a 21st century epidemic. How the laboratory can help<br/><i>S Darch, London</i></p> | <p>31 Cerebrospinal fluid analysis in multiple sclerosis and neuroborreliosis: free light chains compared with oligoclonal bands and IgG, IgA, IgM synthesis<br/><i>U Wurster, Hannover, Germany</i></p> |
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## Microbiology

- 32 Diagnosis of sepsis in a paediatric setting comparing blood cultures and the SeptiFast PCR system  
*E A Green, K Harris, N Klein, J Hartley, London*

## Gut

- 32 Ghrelin and obestatin transport by lipoproteins  
*E Holmes, I Davies, G Lowe, M Baines, L Ranganath, Liverpool*
- 32 Improving the reliability of the faecal elastase test  
*S Knowles, M J W Russell, J M Rowbottom, J M Forsyth, N Lawson, Derby*
- 33 The urea breath test: a review of current assay performance  
*S Knowles, M J W Russell, J M Forsyth, N Lawson, Derby*
- 33 Faecal lactoferrin: comparison of the quantitative IBD SCAN and qualitative IBD EZvue  
*L Foye, P Wilson, R Sidhu, A Lobo, M McAlindon, A Wright, D Sanders, S Morley, Sheffield*
- 33 Measurement of plasma 5-hydroxyindoleacetic acid and 5-hydroxytryptamine in the study of gender and menstrual status in irritable bowel syndrome  
*H Perry, W Atkinson, B Keevil, L Houghton, Manchester*
- 34 An improved assay for the measurement of pancreatic faecal elastase-1 using a novel dry faecal collection device  
*P Kampanis, L Ford, J Berg, Birmingham*

## Liver

- 34 Factors affecting gamma glutamyltransferase in normal subjects  
*S Bulusu, I Ali, S Bax, S Sivakumar, F Warburton, London*
- 34 The role of BNP as a marker of structural cardiac disease in patients with cirrhosis  
*R L Langworthy, M J Austin, A J Portal, J A Wendon, M Heneghan, R Sherwood, London*
- 35 The role of gamma-glutamyl transpeptidase in screening requests for alkaline phosphatase isoenzymes  
*M H Al-Mossawi, B Shine, Oxford*

## Nutrition

- 35 Monitoring and management of hyperglycaemia during parenteral nutrition  
*L H French, T M Trebble, Portsmouth*

- 35 An observational study of selenium status in patients receiving parenteral nutrition  
*J Baker, A Taylor, N Karanjia, C Livingstone, Guildford*
- 36 The incidence of micro-nutrient deficiencies after gastric bypass bariatric surgery  
*T Likhari, A J Hartland, A Khan, A Elshaw, Walsall*
- 36 Plasma zinc in patients with burning mouth syndrome  
*N B Roberts, E A Roberts, E Dwyer, R C Hall, E A Field, Liverpool*
- 36 The effect of magnesium supplementation in the treatment of chronic alcoholic patients in the acute setting  
*R W A Peake, I M Godber, D Maguire, Wishaw*

## Toxicology/TDM

- 37 Application of biochip array technology for multiplex testing of drugs of abuse in different sample matrices  
*M L Rodriguez, M Piper, D McAleer, R I McConnell, S P FitzGerald, Crumlin*
- 37 Opiate confirmation using LC-MS/MS: application of international drug identification criteria to routine clinical practice  
*E J Fox, S Twigger, K Allen, Leeds*
- 38 Development of a simultaneous LC-TMS assay for the detection of lamotrigine and phenobarbitone using positive and negative ionisation modes  
*A M Yates, B G Keevil, Manchester*
- 38 Stability of thiopurine S-methyltransferase activity in whole blood  
*R Marrington, C Webster, Birmingham*
- 38 An audit of the assessment of the poisoned patient in a District General Hospital  
*S Harris, G Evans, D Walker, K Griffiths, Bangor*
- 39 Urine ethyl glucuronide as a marker of recent alcohol misuse  
*N Walsham, A Marsh, R Sherwood, London*
- 39 Measurement of methadone and metabolite in human breast milk by direct tandem mass spectrometry  
*E R Smith, A Smith, P Sharp, B F Rocks, Brighton*
- 39 Interference from cyclosporin A metabolites is still a problem even with tandem mass spectrometry  
*R S Carling, E O'Driscoll, G Hemnani, J Calvin, G Hammond, Cambridge*

- 40 Routine thiopurine drug monitoring by rapid determination of whole blood metabolite levels  
*V Graham, L Ford, J Berg, Birmingham*
- 40 Amisulpride and sulpiride interfere in the CEDIA® DAU buprenorphine test  
*L Couchman, A Marsh, R Evers, R McAllister, C Paton, R J Flanagan, London*
- 40 Continuing confusion over units in ethylene glycol poisoning  
*G M Frederick, N Lawson, Derby*
- 41 Application of LC tandem-mass spectrometry for the assay of sirolimus in whole blood  
*A T Hughes, L Fass, N B Roberts, G Hammond, Liverpool*
- 41 Mercury exposure leading to nephrotic syndrome and polycythaemia  
*D Bathia, K Allen, K Newton, Leeds*
- 41 A fishy tale: a case of methylmercury toxicity  
*D Bathia, K Allen, K Newton, Leeds*
- 42 Analysis of iron in serum from Becton Dickinson SST vacutainer tubes  
*M S Devgun, S Blackwell, Wishaw*

### **Oncology**

- 42 Clinical audit: the appropriateness of requesting tumour markers by primary care practitioners. Impact of national guidelines; IOW experience  
*A Al-bahrani, R Twiselton, G Weston-Petrides, C Summerhayes, R Peatey, Isle of Wight*
- 42 The role of carcino-embryonic antigen in the identification of recurrence of colorectal cancer  
*D Thompson, K Smith, A Saha, S Gonsalves, R P Baker, D A Burke, P M Sagar, P J Finan, Leeds*
- 43 Tumour marker audit  
*C Hyam, P West, London*
- 43 Total PSA assays for screening  
*S Lamph, C Sturgeon, P White, S Halloran, Guildford*
- 43 Comparison of faecal occult blood and tumour M2-PK in the investigation of colorectal cancer  
*J S C Waldron, D Smith, T Ellison, S Willmott, D Cade, S Mallya, Crewe*
- 44 Bowel Cancer Screening Programme: Southern Hub results  
*N G Stubbs, J Slyfield, Guildford*

### **Cytokines**

- 44 Quantitative profile of cytokines and cytokine related markers in real time with biochip array technology  
*M L Rodriguez, R I McConnell, F M McPhillips, D McAleer, S P FitzGerald, Crumlin*
- 44 The effect of *in vitro* wounding on cytokine production by human dermal fibroblasts  
*A P Brown, W Fergusson, P Pemberton, A Yates, M J Thornton, I Laing, Manchester*

### **Methods**

- 45 Evaluation of the Biomedica serum osteoprotegerin and the soluble receptor activator of nuclear factor-kappa B ligand assays  
*R M Saldana Chaparro, London*
- 45 Validation of Nanodot Array Luminometric Immunoassay: an assay for the simultaneous measurement of tumour markers  
*L M Wainwright, Portsmouth*
- 45 Changes in analytical acceptance for HbA1c had an impact on storage of samples prior to analysis  
*A A Gidman, D J Cartwright, Cambridge*
- 46 MacroAST: 'big' problems with AST  
*S Mapplebeck, P Birmingham, K Parham, V Thurlow, I Bailey, G Griffiths, C Corns, M Fahie-Wilson, Southend*
- 46 Haemolysed samples on the Roche Modular system: adult and paediatric samples compared  
*M J Waterson, T McDonald, Torquay*
- 46 An audit of the frequency of low level haemolysis  
*M Waterson, Torquay*
- 47 An unusual case of multi-parameter interference on Roche E170 immunoassay system  
*L M Cranfield, M Sullivan, L Tillbrook, Westcliff-on-Sea*
- 47 Development of an ID-MS method for measurement of pentosidine, an advanced glycation end-product  
*C Tomkins, C Webster, Coventry*
- 48 An on-line turbulent flow extraction LC-MS/MS method for the quantitative analysis of testosterone in plasma  
*S Robinson, M Kozak, Hemel Hempstead*
- 48 Parathyroid hormone analysis on Beckman® Access 2 compared to DPC® Immulite 2500  
*S S Bajwa, A Viljoen, Stevenage*

- 48 Bilirubin interference in paracetamol assays: Some reagents don't do what it says on the tin . . . but does it matter?  
*S J McCann, M J Al-Jubouri, Prescott*
- 49 Development and evaluation of a simplified procedure for measuring the oxidative stress marker malondialdehyde  
*J Shepherd, A Anderson, E S Kilpatrick, Hull*
- 49 Urine protein/creatinine results and ratios: can we use boric acid containers?  
*J Armer, J Martin, Bolton*
- 49 Bilirubin interference on the Olympus AU2700: should we cancel tests at the levels of icterus recommended by Olympus?  
*J Armer, C Williams, Bolton*
- 50 Audit of traceability of laboratory calibration material  
*W Brown, Harrogate*
- 50 Pseudonormonatremia and pseudohyponatremia in critically ill patients  
*M Griffiths, E Chow, N Fox, R Gama, Wolverhampton*
- 50 The evaluation of the Nicotine Metabolite assay on the Immulite 2000 immunoassay analyser and its use in urine in pregnancy  
*R O'Kelly, C Lynch, C Regan, J O'Leary, Dublin, Ireland*
- 51 A simplified procedure for measuring vitamin D by LC-MS/MS suitable for large throughput of clinical samples  
*S Knox, J Harris, L Calton, A M Wallace, Glasgow*
- 51 Therapeutic monitoring of the antifungal drug itraconazole using LC-MS/MS  
*E J Fox, A Cox, V Maddox, R Barton, R Hobson, K Allen, Leeds*
- 51 The development of a simple LC-MS/MS method for whole blood and plasma choline measurement  
*C Griffith, L Owen, G McDowell, B Keevil, Manchester*
- 52 Development, validation and clinical application of an automated paraoxonase assay  
*E Holmes, M Baines, L Ranganath, Liverpool*
- 52 Evaluation of a salivary oestradiol assay for the monitoring of hormone replacement therapy  
*G Purcell, D Henson, L Morgan, Nottingham*
- 52 25-OH Vitamin D calibration study between UK liquid chromatography - mass spectrometry users  
*A M Yates, L J Owen, L J Calton, S D Gillingwater, B G Keevil, Manchester*
- 53 The effect of matrix on 25-OH vitamin D2 and D3 calibrators  
*A M Yates, L J Calton, L J Owen, B G Keevil, Manchester*
- 53 Evaluation of a direct ISE method for the measurement of sweat chloride  
*S M E Oxford, S McArthur, A Trewick, D Wright, Harrow*
- 53 High-throughput measurement of 25-hydroxy vitamin D3  
*S Costelloe, E Woolman, S Rainbow, L Stratiotis, G O'Garro, S Whiting, M Thomas, London*
- 54 A highly sensitive assay for testosterone measurement by tandem mass spectrometry using a Waters Quattro Premier XE system  
*H Hawkes, G Holder, D Andrews, R Cramb, Birmingham*
- 54 Comparison of manual and automated spectrophotometric assays for salivary  $\alpha$ -amylase  
*N Djedovic, S Rainbow, S Laing, M Cardinale, Harrow*
- 54 Adjustment of direct bilirubin results in haemolysed neonatal samples  
*E R Smith, G Weaving, A Walker, B F Rocks, Brighton*
- 55 Securing funding for novel assays in West Norfolk: the BNP story  
*K J Ashurst, C P Chan Seem, King's Lynn*
- 55 Development of a quantitative capillary electrophoresis method for detecting  $\beta$ 2transferrin: a marker of cerebrospinal fluid leakage  
*J A Glaysher, I Watson, Liverpool*
- 56 Development of an in-house ultrasensitive ELISA for C-reactive protein  
*H Owen, S Davis, D Hullin, Llantrisant*
- 56 Stability of free catecholamines and free methyl-derivatives at pH 2.0, 4.0, 6.0 and 8.0 and different temperatures over 10 weeks  
*M Sargazi, G Higgins, N Roberts, Wirral*



- 56 Analysis of buprenorphine and norbuprenorphine in urine by HPLC-MS/MS  
*L Couchman, A Marsh, P Morgan, R Evers, R J Flanagan, London*
  - 57 Evaluation of imprecision of Advia Centaur® TNI-Ultra™ automated immunoassay  
*M Redpath, G Chalmers, C Dibden, B Morris, A Blumsohn, Sheffield*
  - 57 Comparison of liquid chromatography tandem mass spectrometry and radioimmunoassay for measurement of salivary cortisol  
*S Haslam, L Owen, B Keevil, C Glen, P Wood, Manchester*
  - 57 Prevalence of hyperprolactinaemia due to macroprolactin with the Roche Prolactin II assay and audit of a macroprolactin screening programme  
*P Mackenzie, S Mapplebeck, J Ahlquist, S Brough, A Dawnay, M Fahie-Wilson, Westcliff-on-Sea*
  - 58 Salicylate measurement: is there a merit in using in-house reagents on a modern laboratory analyser in the 21st century?  
*M S Devgun, J McNicol, C McDonald, Wishaw*
  - 58 Rapid bile acid testing: the case for an in-house service  
*K J Ashurst, C P Chan Seem, King's Lynn*
  - 58 Simultaneous determination of guanidinoacetate, creatine and creatinine in urine, plasma and CSF by underivatized liquid chromatography tandem mass spectrometry  
*R Carling, S Hogg, J Calvin, Cambridge*
  - 59 Selected Ion Flow Tube Mass Spectrometry assay of methanol, ethanol and isopropanol in aqueous samples by headspace vapour analysis  
*L Rowbottom, C Workman, N Roberts, Liverpool*
  - 59 Underestimation of vitamin D by ELISA in patients taking vitamin D supplements: a significant problem  
*A Bowron, J Scott, F Morgan, T Thorpe, Bristol*
  - 60 Development and evaluation of a method using ICP-MS for assay of whole blood and plasma manganese  
*C Rees, E Roberts, N B Roberts, Liverpool*
  - 60 A comparison of new generation high density lipoprotein cholesterol homogeneous assays compared with previous generation and ultracentrifugation assays in patients with a range of triglyceride concentrations  
*D McKillop, D McIlveen, L Carson, E Duly, P Auld, P Sharpe, Craigavon*
  - 61 Development of an acid hydrolysis method for the quantification of urinary total opiates by LC-MS/MS  
*A J Armitage, C Webster, Birmingham*
  - 61 Utility of the YSI and Beckman DxC glucose analysers for clamp studies: a method comparison  
*M J Turzyniecka, K Sensier, J Wood, Southampton*
  - 61 Measurement of plasma 5-hydroxyindoleacetic acid by liquid chromatography tandem mass spectrometry  
*H Perry, B Keevil, Manchester*
  - 62 Measurement of urinary dopamine by liquid chromatography tandem mass spectrometry: apparent freedom from interference  
*H Perry, K Graham, B Keevil, Manchester*
  - 62 Evaluation of an atomic absorption method for measuring serum and urine strontium  
*A M Milan, S Holland, R Thakrar, S J Iqbal, Leicester*
  - 62 Implementing a fast method for urine steroid hydrolysis prior to GCMS analysis  
*R P Vincent, S Christakoundi, S M Hadi, C Greenaway, N F Taylor, London*
  - 63 Comparison of flame atomic absorption and spectrophotometric assays for serum copper  
*P J Twomey, C Morrow, S Hanley, K B Raja, Ipswich*
  - 63 Automated immunoturbidimetric methods for caeruloplasmin are not standardised  
*K B Raja, S Hanley, C Morrow, P Twomey, London*
  - 63 The detection of 25-OH vitamin D2 by the DiaSorin Liaison 25-OH vitamin D assay  
*A Morovat, Oxford*
  - 64 Selective analysis of quinine and quinidine in serum/plasma by fast HPLC  
*P Morgan, L Couchman, M Owen, R J Flanagan, London*
- Instrumentation**
- 64 Evaluation of ammonia, lipase, lithium, cholinesterase and lactate on the VITROS 250 chemistry system  
*C W Lam, J R Koh, Singapore*

- 65 An "epidemic" of specimen haemolysis caused by a pneumatic tube transport system  
*G Ellis, Livingston*
- 65 Tosoh G8: can a 1.6 minute run time still deliver quality HbA1c results?  
*A Parnham, S Carey, Ashington*
- 65 Analyser Monitoring Programme: October 2006 - September 2007  
*E French-Mowat, S Halloran, Guildford*
- 66 Detection of haemolysis in neonates: low vs HI tech  
*A Sharma, S Neale, J Jeffery, R Ayling, Plymouth*
- 66 Lean processes across specimen reception and an integrated analytical platform generate sustainable reductions in turnaround times  
*R Taylor, T James, I Draisey, M Gales, S Justice, Z Maunsell, J Kay, B Shine, Oxford*
- 66 Analyser Monitoring Programme for immunoassay analysers  
*C Piggott, S Halloran, Guildford*
- 67 Rationalising pathology services at Royal Gwent Hospital simplifies workflow, reduces demands on staff and cuts turnaround times  
*G Llewellyn, B Massingham, S Sharland, P Waters, Newport*
- 67 Evaluation of hCG analysis on the Olympus AU3000i immunoassay analyser  
*A Forster, R Harris, P Mughal, A Parnham, North Shields*
- 67 Roche Modular: assessment of serum indices for general chemistry analytes  
*P A Miall, H Finney, London*
- 68 Evaluation of the Menarini F360 benchtop analyser  
*B Shah, S Brown, T James, R Taylor, Oxford*
- 68 Simultaneous measurements of cyclosporin, tacrolimus and sirolimus by liquid chromatography and tandem mass spectrometry  
*C Ingram, A Morovat, I Smith, Oxford*
- 68 Improved TAT achieved through radical automation in routine virology  
*D Ellis, J Roche, S Lees, Manchester*
- 69 Evaluation of the consolidated Beckman Coulter UniCel® DxH 880i analyser  
*T Rieger, I Herzum, J Funke, A Kirov, Oberhausen, Germany*

## Miscellaneous

- 69 Spurious hyperkalaemia due to EDTA contamination: common and not always easy to identify  
*M P Cornes, C Ford, R Gama, Wolverhampton*
- 69 Managing demand for thyroid function tests at Mid Cheshire Hospital  
*M Davies, S Mallya, Crewe*
- 69 An audit to assess the uptake of recently introduced laboratory tests within the Thames Region  
*P West, London*
- 70 An audit of the detection of new serum paraproteins in a District General Hospital  
*P West, London*
- 70 Interference with Roche's enzymatic method for creatinine by phenindione: report of two cases  
*A Sankaralingam, R Swaminathan, London*
- 71 PITSTOP: an example of cross discipline and primary-secondary care co-operation targeting improved men's health  
*A Parnham, N Mandava, A Reynolds, North Shields*
- 71 How effective is reflective testing compared with reflex testing?  
*R Srivastava, M Murphy, Dundee*
- 71 An audit of the demand for tumour markers during 2004-2007 in Wirral  
*M Sargazi, M Leonard, Wirral*
- 72 Pilot audit on the management of hypernatremia in hospitalised patients  
*P Gupta, I Haq, S J Iqbal, Leicester*
- 72 Utility of reflective testing assessed in terms of number needed to diagnose  
*P Gupta, P P Shivarudrappa, M Webster, Leicester*
- 72 CYP2B6 G516T genotyping in patients with HIV: a pharmacogenetics study of the antiretroviral, efavirenz  
*V Powers, A Bowron, M Gompels, Bristol*
- 73 Pneumatic air tube transport systems: a recognised but often forgotten cause of *in vitro* haemolysis  
*H T Shepherd, M Bosomworth, Leeds*
- 73 Taking guidance to the user: 10 words in 10 seconds?  
*S Smellie, Durham*

## Posters to be displayed on Wednesday

### Cardiovascular

- 74 Plasma coenzyme Q10 is an independent predictor of total mortality in patients with chronic heart failure  
*C M Florkowski, S L Molyneux, A M Richards, P M George, Christchurch, New Zealand*
- 74 Audit of referrals to the lipid clinic following the publication of JBS2 guidelines  
*M Arias, H Ashby, A Haddon, M Labib, Dudley*
- 74 The prognostic significance of cystatin C in patients undergoing cardiac surgery  
*J D McNeilly, W J Mutch, B Cuthbertson, D Rae, G Gibson, K Buchan, H El-Shafei, R Jeffrey, P Gibson, G S Hillis, B L Croal, Glasgow*
- 75 The prognostic utility of B-type natriuretic peptide in patients undergoing cardiac surgery  
*J McNeilly, B Cuthbertson, W Mutch, G Hillis, D Ray, P Gibson, R Jeffrey, K Buchan, H El-Shafei, G Gibson, B Croal, Glasgow*
- 75 The impact of the provision of extended laboratory service for troponin T assay on hospital admissions  
*S M Coughlin, I Walker, W Wassif, Bedford*
- 75 Audit of 24 hour ambulatory blood pressure versus clinic measurements for adjusting anti-hypertensive treatment  
*J Raju, D Kennedy, S Ramachandran, Sutton Coldfield*
- 76 Is the measurement of plasma choline in patients presenting with symptoms of acute coronary syndrome predictive of subsequent events?  
*C Griffith, R Body, B Keevil, G McDowell, Manchester*
- 76 Obestatin and cardiovascular risk factors  
*E Holmes, M Baines, L Ranganath, Liverpool*
- 76 An audit assessing the establishment and utility of NT-proBNP analysis in support of community heart failure services  
*P Auld, J Hamilton, J McCall, P Nicholls, Belfast*
- 77 The use of BNP as a prognostic indicator following cardiac surgery  
*R L Langworthy, S Attaran, J Desai, L John, A El-Gamel, R Sherwood, London*
- 77 Can laboratory intervention improve cholesterol monitoring and target attainment?  
*M Parsons, Z Wang, C Street, Colchester*

- 78 Guideline-led cholesterol monitoring: is it appropriate, timely and effective?  
*Z Wang, M Parsons, C Street, Colchester*
- 78 Are serum C-reactive protein levels too variable to be used for individual cardiovascular risk stratification?  
*H Owen, S Davis, D Hullin, Llantrisant*
- 78 Fetuin-A and arterial stiffness in a cohort of chronic kidney disease patients  
*E R Smith, L Tomlinson, G Weaving, S Holt, B F Rocks, Brighton*

### Diabetes

- 79 HbA1c and oral glucose tolerance test in subjects with impaired fasting glycaemia  
*T Likhari, T Aulakh, B Singh, R Gama, Walsall*
- 79 An audit of the appropriateness of glucose tolerance testing by GPs  
*M Waterson, Torquay*
- 79 Implications of body mass index on estimated glomerular filtration rate: obese patients with type 2 diabetes on metformin  
*V Mishra, K Hayden, J Wilding, Liverpool*
- 80 The relationship between HbA1c and fructosamine in patients with diabetes and sickle cell or haemoglobin D trait  
*L J Morgan, A A Syed, J Carr-Smith, M N Roch, R A Round, P G Nightingale, I M Stratton, S C L Gough, J M Smith, S E Manley, Birmingham*
- 80 Oral glucose tolerance tests in primary care: a reliable test?  
*S A Bowles, D Ewins, N Goenka, K Heathcote, R Worth, Chester*
- 80 Adiponectin, leptin and C-reactive protein in type 2 diabetes and obesity  
*M Al-Habori, Sana'a SA, Yemen*
- 81 Comparison of osteoprotegerin and biochemical markers of bone metabolism and calcium homeostasis between diabetic patients and normal subjects  
*R M Saldana Chaparro, N L Petrova, A Korzon-Burakowska, F Warburton, P Vadgama, M E Edmonds, C Moniz, London*
- 81 Significant differences in N-terminal telopeptides of type 1 collagen (NTX) and vitamin D between type 1 and type 2 diabetics  
*R M Saldana Chaparro, F Warburton, P Vadgama, London*

- 81 Prorenin, diabetes and kidney function  
*B J Toole, C J Dorrian, A M J Wallace, Glasgow*
- 82 Prevalence of diabetes mellitus in rural South Africa  
*H van Wyk, A J Groenewald, C M Walsh, Bloemfontein, South Africa*
- 82 Oral glucose tolerance test audit  
*C Hyam, P West, London*
- 82 Management of glycaemic control and cardiovascular risk factors in diabetic patients with renal impairment  
*K Stepien, A Darkins, L Morgan, R Temple, Norwich*
- 83 Interpretation of OGTT results: confusion when the two-hour glucose is lower than fasting  
*D Grenshaw, L Cranfield, C Corns, J Ahlquist, A Day, M Fahie-Wilson, Slough*
- 83 Adiponectin and type 2 diabetes  
*H Delaney, T L Dew, J Alaghband-Zadeh, London*
- 83 Elevated serum sialic acid and NAG enzymuria are associated with early renal impairment in diabetics  
*A Kalansooriya, I Holbrook, P Jennings, P H Whiting, Leicester*
- 84 Audit of postprandial glucose requests in pregnant women following introduction of a combined patient information sheet and request form  
*S P Prosser, J Dale, M Labib, Dudley*
- 84 Urinalysis on Clinitek 500 analyser and quantification of urine total protein and urine albumin in a group of diabetic patients  
*M S Devgun, L Cosgrove, Wishaw*
- 84 Does 'normal' fasting glucose out-rule glucose abnormalities?  
*P G McGing, R Al-Agha, E Wright, B Kinsley, F Kyne, Dublin, Ireland*

#### **Lipids**

- 85 How far are we from Joint British Guidelines cholesterol targets?  
*M Ramaswamy, D Darby, A-M Kelly, G Horsman, Manchester*
- 85 Use of ApoB and ApoB/ApoA1 ratio to monitor patients with mixed hyperlipidaemia on lipid lowering drugs  
*A El-Kadiki, T A Gray, Sheffield*
- 85 Paradoxical falls in HDL-C with fenofibrate  
*G M Magee, P Sharpe, Belfast*

- 86 Gross hypertriglyceridaemia: not just for Christmas  
*H J Cox, E S Kilpatrick, D P Narayanan, Hull*
- 86 Is calculating LDL-C using the Friedwald formula reliable in patients with mild hypertriglyceridaemia?  
*U Mayana, J Smith, D Vallance, M Labib, Dudley*
- 86 How well do we screen for familial hypercholesterolaemia?  
*M Balasubramani, C Dawson, G Bayly, Bristol*
- 87 Apolipoproteins and lipid indices in South Asian diabetic population: is the discordance due to small dense low density lipoprotein particles?  
*G Katulanda, I Draisey, P Katulanda, D Matthews, B Shine, Oxford*
- 87 Patterns of apolipoproteins and lipid indices in subtypes of diabetes and their associations  
*G Katulanda, I Draisey, P Katulanda, D Matthews, B Shine, Oxford*
- 87 Sequencing the CETP gene in a family with a history of longevity and elevated HDL-cholesterol  
*D Darby, S Keeney, V Charlton-Menys, P N Durrington, Manchester*
- 88 Very low cholesterol without treatment  
*M J Turzyniecka, C D Byrne, Southampton*

#### **Endocrinology**

- 88 Audit of adrenal vein sampling for primary hyperaldosteronism  
*D Bathia, J H Barth, H P Field, Leeds*
- 88 Are short synacthen tests being used appropriately in hospital practice?  
*89A Davison, W Taylor, M J Diver, L Bailey, Liverpool*
- 89 The diagnostic value of measuring mephrines in plasma, by ELISA, in patients selected for clonidine suppression testing  
*G Lee, P Johnston, D McKillop, S Hunter, B Atkinson, P Auld, Belfast*
- 89 Audit on requests for random cortisol at Manchester Royal Infirmary  
*P Negali, M France, Manchester*
- 90 Simultaneous quantitative endocrine tests with biochip array technology  
*M L Rodriguez, F M McPhillips, P Lowry, E O Benchikh, R I McConnell, S P Fitzgerald, Crumlin*

- 90 Testing compliance/absorption/metabolism of prednisolone in severe asthmatic patients  
*J E Heynes, A Mansur, L Midgley, C Webster, Birmingham*
- 90 Seasonal relationship between 25-(OH) vitamin D2 and D3 with sunlight in a West Yorkshire population  
*J H Barth, K Perkins, H P Field, Leeds*
- 91 Accurately predicting Intact PTH results in patients with established renal failure: implications for monitoring renal disease  
*A M Fielding, A J Williams, R G Roberts, K H Poyser, R John, Swansea*
- 91 Comparison of a routine LC-MS/MS assay for testosterone against an isotope dilution GCMS reference method  
*B Keevil, L Owen, S Blincko, C Ramsay, P Sluss, K Van Uyttinghe, L Thienpont, Manchester*
- 91 Validation of a highly sensitive assay for testosterone using UPLC/MS/MS  
*B Keevil, L Calton, L Owen, G Hammond, M Morris, Manchester*
- 92 Development of a liquid chromatography tandem mass spectrometry method for serum progesterone and comparison with Roche E170 immunoassay  
*B Keevil, M Ramaswamy, Manchester*
- 92 Calculation of free testosterone on the Roche Elecsys platform  
*S C Barnes, London*
- 92 How successful is adrenal vein sampling in primary hyperaldosteronism?  
*S C Barnes, M J Scanlon, P A Kyd, London*
- 93 Thyroid associated orbitopathy: the importance of hypothyroidism  
*I Cozma, M Ludgate, C Lane, J Lazarus, Liverpool*
- 93 Plasma 5-hydroxyindoleacetic acid measurement in carcinoid syndrome  
*N Guha, A Morovat, B Shine, Oxford*
- 93 Falsely high plasma oestradiol levels in a 7-year-old girl with precocious puberty  
*A Armston, J Davies, Southampton*
- 94 Determination of urinary free cortisol reference ranges by Abbott ARCHITECT and comparison with other methods  
*K Kilpatrick, C Brown, A Magill, J Cundick, I Young, B Sheridan, Belfast*
- 94 Is there a role for carbonic anhydrase in glucose-stimulated insulin secretion?  
*A Yates, L Best, A Sener, H Jijakli, S Asl, P Courtois, S Meuris, W Malaisse, Manchester*
- 95 An evaluation of the new Roche Elecsys automated immunoassay for vitamin D3  
*P Smith, Swansea*
- 95 Comparison of salivary cortisol and serum cortisol measurement in patients with a suspected adrenal pathology  
*S K Haslam, L Owen, I Perogamvros, B Keevil, Manchester*
- 95 The short synacthen test: should laboratories report the confidence interval of serum cortisol to improve decision-making?  
*A Sanders, D Vallance, M Labib, Dudley*
- 96 Reference intervals for the DiaSorin calcitonin assay  
*R Ramachandran, P Benfield, S White, R Chapman, N Martin, M Donaldson, London*
- 96 Investigating the relationship between serum 11-deoxycortisol levels and blood pressure  
*H E Turner, C Glenn, P J Wood, Southampton*
- 96 Evaluation of LC-MS/MS confirmation of high serum testosterone results in female patients  
*V Clough, L Perry, J Barth, H Field, London*
- 97 Are we following the thyroid guidelines in Trent?  
*J Monaghan, J Forsyth, P Masters, Derby*
- 97 A comparison of three commercial direct immunoassays for serum cortisol with a liquid chromatography-tandem mass spectrometry assay  
*P Hyde, L Owen, B Keevil, Boston*
- 97 Concise thyroid function testing guidelines for use in primary care in Cornwall  
*A L Barton, R A Fisher, K Evans, D Browne, J W Foote, J Pinkney, Truro*
- 98 Circulating anti-Mullerian hormone is elevated in IVF candidates with PCOS suggesting a role for this glycoprotein in the dysregulated folliculogenesis  
*I Laing, P Pemberton, A Yates, D Gould, A Ahmad, S Roberts, L Nardo, Manchester*
- 98 Low grade inflammation, as evidenced by basal high sensitivity CRP, is not correlated to outcome measures in IVF  
*I Laing, S Robinson, L Nardo, P Pemberton, S Roberts, Manchester*



- 98 Measurement of urinary free cortisol using APCI-liquid chromatography tandem mass spectrometry and comparison with two different immunoassay methods  
*J Mutton, J Heynes, C Webster, D Kennedy, Sutton Coldfield*
  - 99 Calculated free testosterone in males with suspected hypogonadism  
*D T Vallance, M Labib, Dudley*
  - 99 Free cortisol index is a better marker of hypothalamus-pituitary-adrenal axis reserve than serum total cortisol in patients with liver impairment  
*R P Vincent, C W le Roux, T Dew, W Bernal, J Wendon, J Alaghband-Zadeh, London*
  - 99 Prolactin/macroprolactin analysis on the Beckman Dxl  
*P O'Shea, B Byrne, P Barrett, W Tormey, Dublin, Ireland*
  - 100 Audit of serum prolactin requests in a District General Hospital  
*L Peck, S Lee, P West, P Hyatt, London*
- Renal Disease**
- 100 Creatinine requesting from general practitioners pre- and post-introduction of automatic eGFR reporting  
*A A Gidman, D J Cartwright, Cambridge*
  - 101 Does erythropoietin insufficiency in patients with chronic kidney disease contribute to raised cardiac troponins?  
*T McDonald, J O'Connor, Exeter*
  - 101 Reporting significance of change in eGFR and serum creatinine concentrations in chronic kidney disease  
*W A Bartlett, C G Fraser, Dundee*
  - 101 Bone metabolism and its relationship to kidney disease in a UK residential care home population  
*J Carter, G Eaglestone, S O'Riordan, M Delaney, E Lamb, Canterbury*
  - 102 Audit of renal calculi in North East Welsh population  
*V Mishra, P Hudson, C Williams, Wrexham*
  - 102 eGFR reporting in the Wirral: a review after six months in practice  
*A Kremmyda, W D Neithercut, Shrewbury*
  - 102 Audit of requesting of iron studies from renal services  
*L F Brown, W A Bartlett, Dundee*
  - 103 Vitamin D supplementation: a boon or blight  
*T Likhari, P Giles, Walsall*
  - 103 Compliance with K/DOQI guidelines for calcium, phosphate, calcium phosphate product in a study of CKD patients  
*M Mirzazadeh, J Barron, H Gallagher, S Patel, Carshalton*
  - 103 The effect of NEQAS recommended adjusted eGFR formulae on CKD classification in patients with kidney disease  
*M Mirzazadeh, J Barron, H Gallagher, S Patel, Carshalton*
  - 104 Cystatin C is unreliable as a surrogate for glomerular filtration rate in the presence of proteinuria  
*N B Roberts, T Ledson, M L P Howse, G J Kemp, P S Williams, Liverpool*
  - 104 The impact of eGFR reporting in primary care at Southend Hospital NHS Trust  
*S Mapplebeck, P Mackenzie, P Harnett, Southend*
  - 105 Longitudinal study of troponin in established renal failure  
*K H Poyser, R G Roberts, Aberystwyth*
  - 105 Delay in separating blood samples can lead to increases in eGFR due to interference in creatinine estimation  
*L Ford, J Berg, Birmingham*
  - 105 A case of persistent cystinuria following resolved renal Fanconi syndrome after ingestion of herbal medicines  
*R Patle, M Lapsley, M Egerton, H Gallagher, A Taylor, Epsom*
  - 106 A study of the relationship between albumin and total protein excretion at different dipstick protein levels  
*G Collier, M Greenan, J Brady, B Murray, S K Cunningham, Dublin, Ireland*
  - 106 An audit in primary care of short-term progression of CKD 3 based on eGFR  
*R Srivastava, W Bartlett, M Murphy, Dundee*
  - 106 Can attenuated total reflectance infrared spectra of renal stone be analysed against conventional transmission spectra libraries?  
*P Mohammed, D Coley-Grant, J Berg, Birmingham*

## Hormones

- 107 Stability of testosterone and androstenedione in refrigerated serum samples  
*C Griffith, L Owen, B Keevil, Manchester*
- 107 Stability of parathyroid hormone in potassium-EDTA plasma collection tubes compared to plain clotted serum tubes  
*W Bradbury, K Perkins, Carlisle*
- 107 Loss of progesterone from serum in gel blood collection tubes  
*W Bradbury, K Perkins, Carlisle*
- 108 Different results for macro-TSH using different assays: a possible mechanism  
*E English, D Cartwright, P Barker, P Mackenzie, R John, M Fahie-Wilson, D Halsall, Cambridge*
- 108 Does restricting thyroid-stimulating hormone to below 2 mU/L affect free T4 reference range?  
*D Powell, G Waite, J Kane, A Heald, A Rudenski, Salford*
- 108 A case of pituitary disease during a survey of thyroid function testing  
*J Wicking, C Stratton, London*
- 109 Investigation of adrenal suppression in patients with bronchiectasis on inhaled corticosteroids using serum free cortisol  
*N L Barlow, J Holme, P Clark, G Holder, Birmingham*
- 109 Comparison of methods for measuring serum free cortisol  
*N L Barlow, P Clark, J Holme, G Holder, Birmingham*
- 109 Investigation of sample stability in endocrine immunoassays on the Immulite 2000  
*N Randles, J Kane, M Guy, A Rudenski, Salford*
- 110 Variation in IGF-I results and reference ranges limit its effectiveness in clinical practice  
*M Young, N J Porter, G Wark, Guildford*
- 110 Development of a novel radioimmunoassay for human hepcidin-25  
*M Busbridge, R Chapman, London*
- 110 Trent regional survey of the procedure and interpretation of the short synacthen test with proposed guidelines  
*P Gupta, J Falconer-Smith, F Al Ubaidi, Leicester*
- 111 Salivary free cortisol reference range on the Roche E170 platform after collection with Salimetrics Sorbette® ("Eyespear")  
*T S Pillay, C Haumann, C Bonitoattwood, F Omar, K Thomas, Cape Town, South Africa*

## Haematology

- 111 An unusual case of polycythaemia  
*D Pledger, A Ademokun, Ipswich*
- 111 Potential role of serum methyl malonic acid as an aid to diagnosing cobalamin deficiency  
*C Boot, A Brain, M Penney, Newport*

## Posters to be displayed on Thursday

### Paediatrics

- 113 Schiff base formation and its implications in the blood spot succinylacetone measurement by electrospray mass spectrometry/mass spectrometry in the exclusion of tyrosinaemia type 1  
*Z Arkir, C Turner, N R Dalton, F Carragher, London*
- 113 The use of microalbuminuria as a prognostic indicator in neonatal sepsis  
*R Darrah, D Housley, I Ossuetta, Luton*
- 113 Follow-up of babies with abnormal newborn screening results: are we doing enough?  
*L M Shapiro, M Henderson, Leeds*
- 114 An audit on the investigation of hypoglycaemia in a paediatric population  
*S Agalou, S Sankar, F Carragher, J Raiman, London*
- 114 Use of serial BNP measurement in extreme prematurity to detect patent ductus arteriosus  
*D Housley, A De, I Ossuetta, D Freedman, Luton*
- 114 The laboratory investigation of mitochondrial cytopathy at King's College Hospital  
*F C Riddoch, E C Okokon, G Mieli-Vergani, London*

- 115 An audit on the usefulness of interpretive comments  
*S Phillips, M J Henderson, Leeds*
- 115 Free fatty acid reference interval in South African neonates in the first week of life  
*F Omar, G van der Watt, V November, T Pillay, Cape Town, South Africa*
- 115 Massively raised alkaline phosphatase in children: a teaching hospital perspective  
*N Dunbar-Creasey, Manchester*
- 116 Mitochondrial DNA mutations causing Leigh syndrome  
*K P Wright, R Appleton, R W Taylor, A A M Morris, Liverpool*
- 116 Implication of the introduction of haemolysis index measurement on potassium results for neonatal patient samples  
*P A Miall, H Finney, London*
- 117 Medium-chain acyl-CoA dehydrogenase deficiency and ketonuria  
*R W A Peake, P J Galloway, Glasgow*
- 117 The utility of cystatin C in the immediate post-liver transplant period in children  
*E Okokon, M Samyn, A Dhawan, London*
- 117 Aetiology of unilateral pleural effusion: audit of specimen analysis for differentiation of transudate and exudate in a paediatric population  
*O J Driskell, S Heap, Birmingham*
- 118 Potential biomarkers for diagnosing sepsis in adults admitted to an Intensive Care Unit  
*K J Sellar, T Reynolds, A Rhodes, P Collinson, London*
- 119 A study of the value of bedside urine albumin creatinine ratio in predicting outcome in patients with fractured neck of femur  
*P Gosling, E Shears, J Morby, V Gowda, M Manji, K Porter, Birmingham*
- 120 Bedside urine albumin creatinine ratio in predicting patient fitness for discharge from intensive care  
*P Gosling, B Trumper, M Manji, Birmingham*
- 120 Audit of CSF spectroscopy for suspected subarachnoid haemorrhage in a large district general hospital by retrospective case note review  
*M Griffiths, E Chow, R Gama, Wolverhampton*
- 120 Is heparin an incompatible blood specimen anticoagulant for measuring plasma lactate?  
*M S Devgun, E Anderson, Wishaw*
- 121 Admissions with extremely raised CK: causes and consequences  
*D Narayanan, E S Kilpatrick, H Cox, Hull*
- 121 Usefulness of markers of systemic inflammatory response syndrome in the diagnosis of sepsis  
*D T Vallance, S Prosser, M Labib, Dudley*

#### **Point of Care Testing**

#### **Acute Medicine**

- 118 Audit of requests for investigation of CSF xanthochromia  
*D R Pledger, Ipswich*
- 118 Is there still a role for measuring urea in addition to creatinine? Evidence of its use when assessing patient hydration  
*J Shepherd, S Hatfield, E S Kilpatrick, Hull*
- 119 A retrospective audit of spectrophotometry and CSF protein in suspected subarachnoid haemorrhage  
*N Squires, A Cruickshank, Glasgow*
- 119 Assessment of a semi-quantitative method for the measurement of procalcitonin in serum  
*F Stefanowicz, A Mowbray, R Savage, P Wenham, Kirkcaldy*
- 121 Does face to face contact really improve compliance in the use of point of care glucose meters?  
*K Cooper, A Dawnay, London*
- 122 A point of care testing service fit for the 21st century  
*N Hollowood, Harrogate*
- 122 "Point of Confidence": introduction of a new on-line training package for POCT dipstick testing in Northumbria Healthcare NHS Foundation Trust  
*A Parnham, Ashington*
- 123 False positive results with the Guest Medical urine pregnancy test strip  
*A Kremmyda, M Leonard, Shrewsbury*
- 123 Establishment of point of care reference ranges in critically ill patients  
*K Wall, M Russell, V Porter, J Rowbottom, J Forsyth, N Lawson, Derby*

- 123 Comparison of fructosamine measurements from Spotchem EZ sp-4430 analyser, suitable for point of care testing, and Roche Modular P laboratory analyser  
*L J Morgan, R A Round, M Palma, J Carr-Smith, A A Syed, P G Nightingale, I M Stratton, S C L Gough, J M Smith, S E Manley, Birmingham*

- 124 Evaluation of a point of care system for the determination of HbA1c  
*N Joonus, A Gulaid, R Ahsan, Quatre Bornes, Mauritius*

- 124 Assessment of operator error rate and incident reports associated with an out of hours POCT service using Abbott i-Stat analysers  
*R P Hill, A Barnes, T Carrington, Mansfield*

#### **Proteins/Enzymes**

- 124 Serum free light chain assay for diagnosis and monitoring of monoclonal light-chain diseases: analytical and clinical correlations  
*J Tate, S Bazeley, S Sykes, P Mollee, Brisbane, Australia*
- 125 Identification and prevalence of an IgG complexed (macro) form of vitamin B12 in patients with elevated serum B12 concentrations  
*J Jeffery, H Millar, S B Jefferies, P MacKenzie, M N Fahie-Wilson, R M Ayling, Plymouth*
- 125 Should the cut-off values for faecal calprotectin and lactoferrin be age-related?  
*J Jeffery, S Joshi, S J Lewis, R M Ayling, Plymouth*
- 126 Faecal tumour M2-PK values in healthy subjects  
*J Jeffery, S Joshi, S J Lewis, R M Ayling, Plymouth*
- 126 Investigations into the molecular mechanisms of ochratoxin A in a model gastrointestinal epithelium  
*G Dodds, C O'Neill, Manchester*
- 126 Is ferritin a marker for round cell differentiation in semen?  
*M Donaldson, C Dearing, T Ryder, R Chapman, K Lindsay, London*
- 127 Glutathione peroxidase activity in relation to the state of activation of peripheral blood lymphocytes in patients with aspirin-induced asthma  
*A M Hassan, Manchester*

- 127 Monoclonal protein quantitation: a comparative study using Beckman Array 360 analyser and Sebia densitometric phoresis system  
*M S Devgun, E Balmer, Wishaw*

- 127 Fluoride-oxalate interference in lactate dehydrogenase measurement using the Siemens Advia 2400 P-L assay  
*Z J Maunsell, M Strong, T James, A Morovat, Oxford*

#### **Molecular Biochemistry**

- 128 Real time screening for genetic haemochromatosis using the Roche 480 LightCycler  
*L Ford, S Clay, J Berg, Birmingham*
- 128 Circulating mRNA in the assessment of congestive heart failure  
*E C Fung, R Swaminathan, A Butt, London*

#### **Molecular Genetics**

- 128 Apolipoprotein-E genetic polymorphism in relation to blood levels of homocysteine and C-reactive protein in schizophrenic patients  
*A Akanji, J Ohaeri, S Al-Shammri, H Fatania, Safat, Kuwait*
- 129 Interleukin 6 (-174G/C) gene promoter polymorphism is associated with cardiovascular disease in overweight/obese rheumatoid arthritis patients  
*J P Smith, V F Panoulas, K J Douglas, M Labib, G D Kitas, Dudley*
- 129 A cellular localisation approach to unlock the functional mechanism behind the role of the GSTP1 gene in asthma  
*O Driskell, S Pountain, P Hoban, A Fryer, Stoke-on-Trent*
- 129 Sequence variants in the calcium-sensing receptor gene in familial hypocalciuric hypercalcaemia patients  
*J L Usher, W Taylor, J Devine, W Fraser, Liverpool*
- 130 Development of a DNA array for the detection of mutations causing familial hypercholesterolaemia  
*C S Boot, I McDowell, S Whatley, M Hong Shen, M Upadhyaya, Cardiff*
- 130 Development and comparison of assays for the investigation of CYP2D6 variants  
*M Barr, D Gaffney, R Spooner, Glasgow*

- 131 Foetal epidermal growth factor susceptibility haplotype associated with foetal growth restriction  
*L Faraj, E Lonsdale-Eccles, V Dissanayake, C Tower, L Morgan, Nottingham*

### **Bone Disease**

- 131 Serum biochemical markers of bone turnover and inflammation in Charcot diabetic arthropathy  
*R Musto, N Petrova, T Dew, R Sherwood, M Edmonds, C Moniz, London*
- 131 An audit of vitamin D testing in the Cape Town metropole  
*D Haarburger, M Hoffmann, T Pillay, University of Cape Town, South Africa*
- 132 High resolution electron microscopy identifies distinctive binding of ochronotic pigment to collagen fibres in alkaptonuria  
*L R Ranganath, A M Taylor, I Prior, P J M Wilson, W D Fraser, J A Gallagher, Liverpool*
- 132 Development of an *in vitro* model of ochronosis in chondrocyte culture  
*L R Ranganath, A M Taylor, P M Wilson, W D Fraser, J A Gallagher, Liverpool*
- 132 The influence of eGFR on some metabolic determinants of bone mineral density  
*M Baines, M-B Kredan, A Davison, C West, W D Fraser, L Ranganath, Liverpool*
- 133 The association of homocysteine with markers of oestrogen and androgen status in post-menopausal women  
*M Baines, A Robinson, M-B Kredan, A Davison, C West, M J Diver, W D Fraser, L Ranganath, Liverpool*

### **Case Histories**

- 133 Multiple causes and consequences of hypercalcaemia in a single patient  
*R Barski, M Spring, Kingston Upon Thames*
- 133 An unusual case of hypoglycaemia in a child  
*B Harris, A Bowron, J Shield, Bath*
- 134 Child overdose on pet dog's thyroxine  
*A E Garner, S Goodall, Leeds*
- 134 Case report: Negative LDL cholesterol level estimated using the Friedewald equation  
*O C Maguire, D McCarthy, S K Cunningham, Dublin, Ireland*

- 134 Statin-induced autoimmune hepatitis: is it a class effect or statin-specific?  
*M Arias, H Ashby, A Haddon, M Labib, Dudley*
- 135 Late-onset congenital adrenal hyperplasia: is the low-dose synacthen test more sensitive than the standard synacthen test in assessing cortisol reserve?  
*H Ashby, M Arias, S Mehmoona, A Haddon, M Labib, Dudley*
- 135 A case of Hand-Schüller-Christian histiocytosis presenting with diabetes insipidus  
*A Haddon, H Ashby, M Arias, A Babburi, M Cushley, M Labib, Dudley*
- 135 A case of macro-LDH associated with minor other enzyme abnormalities  
*M J Waterson, Torquay*
- 136 A rare presentation of glycogen storage disorder with type 1 diabetes  
*D Narayanan, E S Kilpatrick, Hull*
- 136 Polyclonal immunoglobulin G is a negative interferent in the Roche HDL-C plus 2nd generation assay but not in the Roche HDL-C plus 3rd generation assay  
*M Griffiths, V Jahagirdar, J Fernando, R Gama, Wolverhampton*
- 136 Chronic paracetamol ingestion precipitating transient pyroglutamic aciduria  
*H Seddon, Derby*
- 137 A case of NSTEMI-ACS?  
*L Brown, A Pall, Dundee*
- 137 Myxoedema coma presenting with severe hypothermia  
*E Holmes, D Wile, Liverpool*
- 137 Peritoneal dialysis for chronic renal failure in a patient with methylmalonic acidemia  
*C A Chadwick, K P Wright, A A Morris, C A Jones, Liverpool*
- 138 A case of Dent's disease?  
*K L Williams, V De Silva, Gillingham*
- 138 A case of remnant hyperlipidaemia with an interesting history  
*K L Williams, V De Silva, Gillingham*
- 138 A case of dramatic weight loss and its consequences  
*S Hancock, R Still, J Doran, J Baxter, Swansea*
- 139 Possible Gitelman's syndrome without alkalosis  
*S Hancock, R Still, M Stevens, Swansea*



- 139 An interesting case of pseudohypoparathyroidism  
*P West, P Kapila, London*
  - 139 Monoclonal cryoglobulinaemia: clinical and analytical aspects  
*E R Smith, G Weaving, B F Rocks, Brighton*
  - 140 A case of Gitelman's syndrome with associated refractory epilepsy and a novel mutation  
*P Gupta, S J Iqbal, Leciester*
  - 140 Inconclusive biochemical investigations in ACTH dependent Cushing syndrome  
*H Abraha, S Chambers, S Aylwin, London*
  - 141 A case of gynaecomastia due to a large adrenal carcinoma secreting multiple steroids  
*A L Barton, J W Foote, S Lakshmi, J Mitchard, R A Fisher, Truro*
  - 141 A tale of three countries, a case of hypercalcaemia  
*J Glaysher, C Reeves, Liverpool*
  - 141 Why is my patient's calcium suddenly rising?  
*L Cranfield, C Corns, Westcliff-on-Sea*
  - 142 A case of Conn's syndrome in an 11 year old  
*C A Collingwood, C Jones, Liverpool*
  - 142 Unusual case of extremely high prolactin levels  
*R Azad, D Wright, S Peacey, D Bathia, Bradford*
  - 142 A benign transient hyperphosphatasia of infancy in an adult  
*N Jassam, J Horner, Leeds*
  - 143 Sequelae of non-fatal cyanide poisoning  
*A Gbegbaje, C Davis, J Martin, A Hutchesson, Bolton*
  - 143 Hypogonadotropic hypogonadism  
*T Likhari, R Gama, Walsall*
  - 143 A case of NODAT  
*F C Riddoch, London*
  - 144 5HTP supplementation and diagnosis of carcinoid syndrome: the role of the internet  
*D Pledger, D Fowler, Ipswich*
  - 144 A simple case of pancreatitis?  
*S Mapplebeck, M Fahie-Wilson, Southend*
  - 144 A case of empty sella syndrome associated with hypopituitarism and acute morbid obesity  
*P P Shivarudrappa, P Gupta, W Madira, R Bing, Leicester*
  - 145 A boy with familial dysalbuminaemic hyperthyroxinaemia  
*R John, D J Cartwright, D J Halsall, Cardiff*
  - 145 A 'big' deal  
*B Patel, A Sam, V Salem, A Ogilvie, I Chandarana, M Clements, Watford*
  - 145 A case of Cushing's disease due to a macroadenoma in a 13 year old boy  
*P Newland, N Wild, M Javadpour, C Mallucci, M Didi, J Blair, Liverpool*
  - 146 Interference with lactate measurement in a case of ethylene glycol poisoning  
*P G McGing, D Phelan, F Colreavy, B Marsh, S Maguire, R Dillon-Murphy, J Collier, Dublin, Ireland*
- Quality Assurance**
- 146 An audit of data quality: Down's syndrome screening request forms  
*T Hitch, G Dewey, Nottingham*
  - 146 A survey of performance and practice of serum indices by users of the Roche modular system  
*M Sullivan, M Fahie-Wilson, Westcliff-on-Sea*
  - 147 Gas chromatography mass spectrometry reference targets for the comparison of uric acid assays in serum  
*D H Ducroq, M S Morton, H Fraser, C Strevens, Cardiff*
  - 147 Gas chromatography mass spectrometry reference targets for the comparison of cholesterol assays in serum  
*D H Ducroq, M S Morton, H Fraser, C Strevens, Cardiff*
  - 147 The development and validation of exact matching isotope dilution liquid chromatography mass spectrometry methods for the analysis of certified reference materials  
*C R Mussell, C Pritchard, S Biesenbruch, P Stokes, G O'Connor, S Wood, Teddington*
  - 148 Monitoring the "Sample Journey" from primary care to the laboratory and beyond  
*J Dickens, J Berg, Birmingham*
  - 148 An approach to reduce analytical variability across a multi-sites network  
*N Jassam, K Harrison, N France, D Mallinson, A Hamilton, J Barth, M Bosomworth, Leeds*

## Management

- 148 Audit and intervention can reduce inappropriate requesting: a tumour marker audit  
*S Davie, Kingston-Upon-Thames*
- 149 ACB Audit Group national audit of the short synacthen test  
*J Middle, K Chatha, Birmingham*
- 149 Impact of eGFR reporting on Scottish Clinical Biochemistry Departments  
*J Reeve, J Allison, Aberdeen*
- 149 Successful use of NHSmail for add-on requests  
*J Strachan, W Bartlett, Dundee*
- 150 An audit of preoperative laboratory tests  
*R Swaro, P Banugo, M Sharma, S Bulusu, O-E Mohr, London*
- 150 Managing demand on laboratory services: can RUSSEL help?  
*S J Jarvis, S Balmer, Glasgow*
- 150 Managing demand and laboratory test ordering behaviour: an example using sodium valproate  
*A Viljoen, A Woods, Stevenage*
- 151 Do general practitioners need routine measurement of bicarbonate?  
*S Hatch, Liverpool*
- 151 Is electronic reporting of referred tests long overdue?  
*G M Frederick, Derby*

- 151 Computerised reporting and analysis of incidents and blunders within the clinical laboratory  
*J Kirby, S Cox, S Justice, Z Maunsell, T James, R Taylor, Oxford*
- 152 Impact of 'add-on' tests on the laboratory: Emergency departments requesting patterns  
*M Livingston, P Gupta, W Madira, Leicester*

## Computing

- 152 Blogging and effective EQA management  
*C Webster, Birmingham*
- 152 Laboratory requests as a performance indicator in monitoring and developing the use of a unique patient identifier  
*G Chalmers, F Finlay, Glasgow*
- 153 Development of a web-based system for requesting and reporting post-mortem toxicology  
*S C Griffiths, P Kane, R Hollingsworth, G J Ayers, Manchester*
- 153 Implementation of a comprehensive web browser-based information resource for use by multi-disciplinary staff in specimen reception  
*S Justice, S Cox, J Kirby, M McClure, S Stoker, R Taylor, T James, Oxford*