COLCHESTER CLINICAL BIOCHEMISTRY USER HANDBOOK

Revision 1.0

June 2022

CONTROLLED HARDCOPIES MUST BE SIGNED.	
Document owner (signature):	
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Date:	
Location of hardcopy	

Summary of Changes:
• New document

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1. SCOPE OF THIS HANDBOOK

This User Guide has been produced to assist both hospital and community users of the Clinical Biochemistry laboratory service at Colchester Hospital. It deals with access to the Biochemistry service, specimen requirements, information and labelling requirements.

If this User Guide fails to provide information required, users are encouraged to contact relevant key personnel listed.

The Biochemistry Department will review the User Guide on a yearly basis or as and when new information is available or new test methodologies are introduced.

General information is available on the pathology website: ESNEFT Pathology Service/

2. SERVICE INFORMATION

Biochemistry is considered one of the diagnostic branches of medicine along with other pathology specialties (e.g. microbiology, haematology, blood transfusion and cellular pathology). Biochemistry offer the widest range of diagnostic tests of our pathology services. The department analyses the constituent compounds in blood, urine, faeces, cerebrospinal fluid and sweat to help clinicians screen, diagnose and monitor patient conditions.

Our highly skilled team includes clinical, technical and non-technical staff. Biomedical scientists carry out analytical work with administrative and technical support from medical laboratory assistants and clinical scientists provide clinical support.

We have recognised training laboratories with an active training programme designed to produce the next generation of biomedical and clinical scientists registered with the health care professions council (HCPC).

2.1. KEY PERSONNEL CONTACT DETAILS

Dr Catherine Street (**Consultant Head of Department)**	Catherine.street@esneft.nhs.uk Tel: 01206 742415
Ms Sukhjinder Moore **(Principal Clinical Scientist)**	Sukhjinder.Moore@esneft.nhs.uk
Rizwan Ifrahim **(Senior Clinical Scientist)**	Rizwan.Ifrahim@esneft.nhs.uk
Mrs Sonja Mackenzie **(Laboratory Manager)**	sonja.mackenzie@esneft.nhs.uk Tel: 01206 742244 / Extension 2244
Mr Opindra Pandya **(Service Lead for Biochemistry)**	Opindra.pandy@esneft.nhs.uk Tel: 01473 703704 / Extension: 5704
Mr Stephen Gee **(Biochemistry Quality Manager)**	Stephen.Gee@esneft.nhs.uk
Mrs Sarah Stalley **(Head of Operations)**	Sarah.stalley@esneft.nhs.uk Tel: 01473 703707 / Extension: 5707
Specimen reception	Tel: 01206 742415 Extension 2415)

2.2. LOCATION OF LABORATORY

Biochemistry Department,
Pathology Directorate,
East Suffolk North Essex NHS Foundation Trust
Colchester General Hospital
Turner Road Colchester
Essex CO4 5JL

The Laboratory is situated on the first floor of the Main Hospital building. From the Main entrance at the front of the Hospital, take the first set of stairs on the right and turn right on the first floor. The signs to the Blood Science department will be on the left.

For a location map click on the link: https://docreader.reciteme.com/doc/view/id/5f9803e8ae9f9

2.3. LABORATORY OPENING TIMES

The Laboratory operates a 24-hour service. Full routine and emergency services operate between 09:00 and 17:00. Outside these hours and at weekends an emergency service is provided

2.4. CONTACTING THE DEPARTMENT

2.4.1. Clinical Advice and Interpretation

When considering unusual investigations or requesting interpretative advice, during routine hours telephone the Duty Biochemist via Specimen Reception, telephone: **01206 742415 (ext 2415)**

For urgent enquiries between 5pm-9am Monday-Friday and weekends; the Duty Biochemist may be contacted through the hospital switchboard.

2.4.2. Non Clinical Advice

Biomedical Scientists are available to give advice on technical matters including the transport of specimens, the sample types and the requirement s for acceptance criteria. During routine hours telephone: 01206 742415 (internal extension 2415); out of hours bleep 557

2.4.3. Feedback

The service works closely with users to ensure the service provided meets the needs of the users. This is achieved through discussions at CCG meetings and user surveys.

User surveys are issued to primary and secondary care, results are reviewed and feedback provided. Where concerns are raised these are considered by the service management and where relevant taken into account to improve the service.

If users would like to feedback comments to the laboratory, please contact the Laboratory Manager or Service Lead for Biochemistry (contact details listed above).

2.4.4. Complaints

Users wishing to raise a concern, make a complaint or compliment the department are encouraged to contact the Blood Sciences Quality Manager, Laboratory Manager or the Service Lead to discuss further.

Alternatively contact the Patient and Liaison Service (PALS) - 9am to 4pm, Mon to Fri:

- email PALS@esneft.nhs.uk
- telephone 0800 783 7328 (Direct line 01206 742683 or 746448).

If your call is urgent and you require assistance outside these hours please dial 01206 747474 and ask to speak to the Duty Matron.

Alternatively complaints can be referred to the complaints team at Colchester Hospital: **complaints@esneft.nhs.uk**

2.4.5. Incidents

Incidents relating to this service should be reported on the Datix system available on local PC desktops or on the hospital intranet. All incidents are fully investigated and recorded on the Datix and QPulse Quality Management system.

The Quality Lead for Biochemistry monitors all incidents & complaints on a weekly basis and trends on a monthly basis – this information is fed up to board level and used to inform service improvements.

2.5. SERVICES & TESTS OFFERED BY CLINICAL BIOCHEMISTRY

2.5.1. Emergency Investigations

Urgent requests requiring immediate analysis, all blood gases must be notified by telephone to the department or, after 17:00 and weekends to bleep 557.

All Emergency Department (A&E) requests where there is a likelihood of 4 hour breach must be notified by telephone.

The Following Tests are guaranteed out of Hours

U&E – Sodium, Potassium, Creatinine, Urea	**Glucose**
Bone – Calcium, Phosphate, ALP, Alb, TP	**Serum HCG**
LFT – ALT, ALP, Bilirubin, Albumin, TP	**Lactate**
Lipids – Cholesterol, HDL, Triglyceride	**LDH**
TFT – TSH, FT4	**Lithium**
Ammonia	**Magnesium**
Amylase	**Osmolality**
AST	**Paracetamol**
Bicarbonate	**Salicylate**
Bilirubin	**Phenytoin**
Blood Gases – always bleep staff	**Theophylline**
Carboxyhaemoglobin (COHb)	**Vancomycin**
CK	**Troponin T**
CRP	**HCG**
Cortisol	**Urine sodium**
Digoxin	**CSF glucose and protein**
Gentamicin	**CSF Bilirubin (Xanthochromia)**
GGT	

Requests for tests other than these will be subject to discussion between the requesting clinician and the Consultant Clinical Scientist on-call, obtainable via the Hospital switchboard.

Where tests other than those above are required and it is ESSENTIAL that they are taken during the out of hours period, send them to the laboratory and they will be handled and preserved to ensure that valid analytical results will be obtained when the sample is analysed.
If it is not essential to collect samples at this time, please wait until the laboratory is operating normal working hours.

2.5.2. Requestor Responsibilities

It is the responsibility of healthcare professionals to ensure the samples reach the laboratory, either using portering services or via the air tube, where available.

Please do not telephone the laboratory to ask if the results are available unless there has been an undue delay. Results will be available on ICE and Careflow/Medway Portal. It is the requestors responsibility to follow up results on test results they have ordered.

Only very abnormal / critical results, if not previously abnormal will be telephoned in accordance with departmental and RCPath guidelines.

2.6. PATIENT CONFIDENTIALITY / PERSONAL INFORMATION

ESNFT pathology staff must take annual mandatory Information Governance training to ensure patient, staff and other confidential information is handled securely and safely.

Consent – It is assumed by the laboratory that by sending specimens for analyses the requester has received consent from the patients.

Each request accepted by the Biochemistry service is considered to be an agreement between the laboratory and the requestor.

Clinicians should be aware that the laboratory may reflex tests where clinically indicated or to aid in interpretation

3. SPECIMEN COLLECTIONS & TEST ORDERING

There are two ways to request biochemistry tests at Colchester Hospital:

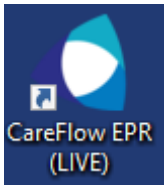
- **Electronic request (Careflow Order Comms) – *preferred method***
- **Manual handwritten request**

3.1. ELECTRONIC REQUESTS (ORDER COMMS)

Electronic requests should be used whenever possible. An electronic request is made using the CareFlow (Medway/Portal) Order comms.

All staff must undergo training on the CareFlow Order comms before access is granted. Training can be booked via the Trust IT helpdesk; ManageEngine ServiceDesk Plus (esneft.nhs.uk)

- Access the CareFlow system via the CareFlow EPR (Live) link - see desk top icon below:



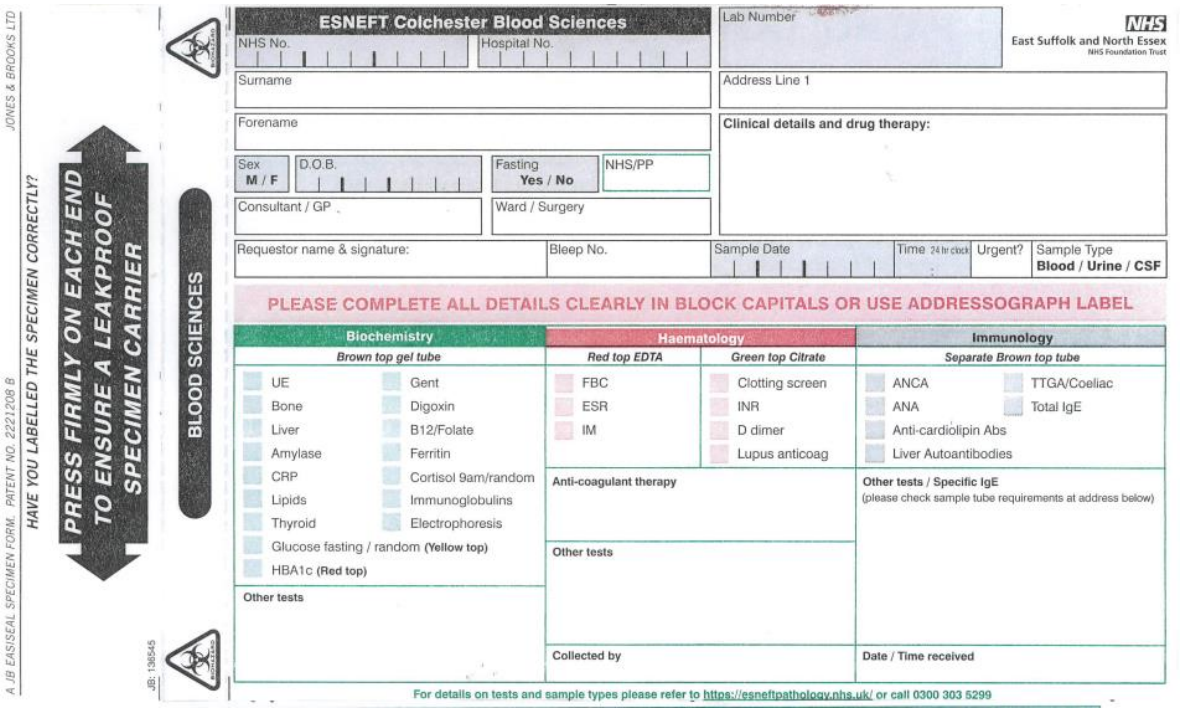
- Make the test requests and sample labels are printed from the CareFlow order comms system.
- Attach the sample labels to all the samples related to the request. Ensure that the appropriate label is attached to the appropriate sample.
- Electronic requests will have information transmitted and visible on receipt in the laboratory. The location may be missing as results are returned to the electronic patient record.

3.2. MANUAL REQUESTS

For non-electronic requests, a request form must accompany each sample. The details stated on the sample must match those as stated on the request form and must include:

- Patient's full name: surname and forename (*abbreviated names are not acceptable*)
- NHS number or hospital number (or A&E generated emergency number)
- Date of birth
- Gender
- The patient's location
- Name of the clinician responsible for the patient results and contact number / bleep
- Investigations required.
- Time and date that the sample was taken added by taker of the samples.
- 24 hour urine specimens should state start / end time of collection (as provided by patient)
- Fasting status, medications and reasons for investigation should be stated on the form.
- Priority status – requests are assumed routine unless marked 'Urgent'

The combined Blood Science request form can be used for biochemistry, haematology and immunology requests. An image of the correct request form is shown below:



ESNEFT Colchester Blood Sciences

NHS No. | Hospital No. | Lab Number

Surname | Address Line 1

Forename | Clinical details and drug therapy:

Sex M / F | D.O.B. | Fasting Yes / No | NHS/PP

Consultant / GP | Ward / Surgery

Requestor name & signature: | Bleep No. | Sample Date | Time 24 hr clock | Urgent? | Sample Type Blood / Urine / CSF

PLEASE COMPLETE ALL DETAILS CLEARLY IN BLOCK CAPITALS OR USE ADDRESSOGRAPH LABEL

Biochemistry (Brown top gel tube)		Haematology (Red top EDTA)	Haematology (Green top Citrate)	Immunology (Separate Brown top tube)	
UE	Gent	FBC	Clotting screen	ANCA	TTGA/Coeliac
Bone	Digoxin	ESR	INR	ANA	Total IgE
Liver	B12/Folate	IM	D dimer	Anti-cardiolipin Abs	
Amylase	Ferritin		Lupus anticoag	Liver Autoantibodies	
CRP	Cortisol 9am/random	Anti-coagulant therapy		Other tests / Specific IgE (please check sample tube requirements at address below)	
Lipids	Immunoglobulins				
Thyroid	Electrophoresis	Other tests			
Glucose fasting / random (Yellow top)					
HBA1c (Red top)					
Other tests		Collected by		Date / Time received	

For details on tests and sample types please refer to https://esneftpathology.nhs.uk/ or call 0300 303 5299

PRESS FIRMLY ON EACH END TO ENSURE A LEAKPROOF SPECIMEN CARRIER

HAVE YOU LABELLED THE SPECIMEN CORRECTLY?

BLOOD SCIENCES

A JB EASISEAL SPECIMEN FORM. PATENT NO. 2221208 B JONES & BROOKS LTD

JB: 136545

PATHOLOGY LABORATORY

NHS East Suffolk and North Essex NHS Foundation Trust

Blood Sciences Laboratory, Colchester General Hospital, Turner Road, Colchester, CO4 5JL

INFORMATION FOR PATIENTS

For information and appointments please visit our website **https://www.esneft.nhs.uk/service/bloodtests/**
For Blood test appointments phone Tel: **0300 303 5299**

INFORMATION FOR CLINICAL STAFF

For results and general enquiries Tel: 01206 742415
PLEASE ENSURE THAT SAMPLES ARE ADEQUATELY LABELLED AND THAT THE FORM IS FULLY COMPLETED

Sarstedt Order of Draw	Example Investigations
BROWN - Serum Gel	Most routine Biochemistry, most routine Immunology, IgE, RAST and antibodies Haematinics (Ferritin, Vitamin B12, Folate and Iron) Therapeutic Drug Monitoring, Gentamicin, Vancomycin, C3, C4, Serum Protein Electrophoresis, Immunoglobulins, Down's Syndrome Screening, (Please use discipline specific Micro, Serology and Virology request form for requests)
GREEN - Citrate Coagulation	Coagulation Screen, INR, APTT ratio, Clauss Fibrinogen, D-dimer, Factor Assays, Lupus Anticoagulant, Thrombophilia Screen, Factor V Leiden, Citrate Platelet Count
ORANGE - Lithium Heparin	Carboxyhaemoglobin, Homocysteine **Trace Metal Tube:** Zinc
RED - EDTA	FBC, ESR, Infectious Mononucleosis, HbA1c, Malaria Screen, CD4/CD8, Haemoglobinopathy, Sickle Cell Test, HLA B27, PTH, ACTH*, Lead, Ammonia*, Cyclosporin, Tacrolimus, Sirolimus, TPMT, PCR/Viral loads (Microbiology/Virology - request on specific request form) 6TGN (2 x red EDTAs)
BLUE - EDTA for Transfusion	DO NOT USE THIS FORM FOR ANY BT REQUESTS
YELLOW - Fluoride	Glucose, Lactate*

For details on sample type for each test please refer to **https://esneftpathology.nhs.uk/** * LABILE TESTS. DELIVER URGENTLY TO BLOOD SCIENCES LAB.

INSERT SPECIMENS IN POCKET AND SEAL AS DIRECTED

The acceptance of this request by the laboratory constitutes an agreement between the laboratory and the requestor for the provision of laboratory services.

BLOOD SCIENCES

Manual request forms for blood sciences can be ordered through the Pathology consumables ordering page: [ESNEFT Pathology Service]

It is the responsibility of the requesting clinician and the sample taker to ensure that request forms and samples are correctly and identically labelled. It is essential that the risk of mis-reporting pathology results is minimised to ensure patient safety and to this end accurate identification of the patient from whom the specimen/ sample was obtained is of paramount importance.

3.3. SAMPLE ACCEPTANCE CRITERIA

The Biochemistry department adheres to ISO 15189 Standards. We require samples to meet specified criteria before they can be accepted for testing.

Each specimen must be clearly labelled by hand or using pre-printed patient labels. The patient details on the specimen must match those on the provided request form.

Samples MUST contain 4 (correct) patient identifiers which are:

- **Surname**
- **Forename *(abbreviated names are not acceptable)***
- **DOB**
- **NHS Number or Hospital Number**

FAILURE TO MEET THE LABELLING CRITERIA WILL RESULT IN SPECIMEN REJECTION

Date and time of sample must also be added to specimen.

3.4. CRITERIA FOR REJECTION OF A SPECIMEN

The following samples will be rejected and a further sample requested:

- Samples with less than 4 identifiers matching on request form and sample tube
- Samples labelled with abbreviated name(s)
- Specimen collected into unsuitable container/ bottle.
- Specimen in expired sample bottle / container.
- Unlabelled samples
- Underfilled samples
- Blood Gas / Pleural Fluid pH specimen containing an air space
- Specimen suspected of pre analytical contamination
- Specimen grossly haemolysed
- Blood specimen received after unacceptable delay
- Specimen which has significantly leaked in transit (an effort should be made to transfer material to another container if collection of a second sample would be difficult, and if safe to do so)
- Specimen taken at inappropriate time
- Request not valid for clinical reasons (as determined by Consultant Biochemist)
- Incorrect specimen type for tests requested
- 24 hour urines with incorrect preservative
- 24 hour urines with an inadequate duration of urine collection may be run as random urine sample once approved by duty biochemist.

4. ADDITION OF FURTHER TESTS TO A REQUEST

Samples are stored for three days in the biochemistry laboratory. Further assays may be added to a request subject to the stability of the analyte in the stored sample, and to sufficient sample being available. To request additional tests send a completed '***Addition of tests form***' to the laboratory.

This form is available on the Pathology intranet page: https://intranet.esneft.nhs.uk/pages/pathology

Blood Sciences Department
REC-COL-FR-026 / v 1.2

NHS East Suffolk and North Essex NHS Foundation Trust

ADDITION OF TESTS FORM FOR BLOOD SCIENCES

- Use this form to add retrospective Biochemistry, Haematology or Immunology tests to samples already received in the lab
- Do not use this form to add on Microbiology tests

Sample date / time		**Sample number**	
NHS or Hospital number			
Surname			
Forename			
Date of birth			
Test(s) to be added			
Date / time of add-on request			
Clinical indication for addition			
Requester (print name)		**Bleep/Phone**	
Signature			
Lab use only			
Archive position:	*Retrieved by:*	*Loaded by:*	

The following tests are NOT available for add on:
Ammonia, Bicarbonate, Blood gases, Chloride, Ethanol, Ferritin, Folate, Gentamycin, Glucose, Lactate, Vancomycin
CSF Glucose, CSF Protein, CSF Xanthochromia,.

5. SAMPLE REQUIREMENTS

5.1. BLOOD SPECIMENS

Samples are collected using the Sarstedt Monovette system in the following containers:

7.5 mL brown top (B)	- no anticoagulant
9.0 mL orange top (O)	- lithium heparin
2.7 mL yellow top (Y)	- Fluoride EDTA
3.4 mL red top (R)	- Potassium EDTA

For paediatric use, smaller volume tubes of the same range are available.

See section 12. TEST LIST & SAMPLE REQUIREMENTS for specific test sample requirements

Please note in most cases, one Monovette will suffice for a variety of tests, e.g. a single brown top 7.5mL tube will allow assay of U&E, LFT, Bone profile, CK etc. There is no need to collect a separate tube for each request unless different types of sample (e.g. both plasma and serum) are required.

5.2. URINE SPECIMENS

Some compounds are unstable in urine and require special collection containers with added preservatives. Do not discard any such preservative.
Refer to section13.PRESERVATIVES FOR URINE COLLECTIONS for details.

5.2.1. 24 HOUR URINE COLLECTIONS

Complete 24 hour urine collections are essential for quantitative analysis. If any urine passed during the 24 hour period is missed from the collection, the collection should be discarded and the collection procedure recommenced using a fresh bottle.

- The collection can be started any time of day, but must finish at the same time on the next day.
- At the start time, empty the bladder and discard the urine. Do not save any of the urine passed at this point.
- The date and time at this point are written onto the bottle.
- All urine produced during the next 24 hours is transferred to the bottle.
- The collection period is completed when the start time is reached the next day. At this time the bladder is emptied and the urine saved in the bottle.
- The collection is now finished and no further urine should be added to the container.
- The time and date of the completion is written on the label.
- Ensure the bottle is labelled with the patient's full name, DOB and NHS / Hospital number.

Storage - During the collection, the bottle should be kept in a cool place and should be sent to the laboratory as soon as possible after completion of collection.

5.3. CEREBROSPINAL FLUID - CSF

CSF samples for glucose and protein should be collected into yellow (fluoride / EDTA) tubes and sent to the laboratory together with a blood sample for the measurement of plasma glucose.

CSF specimens contaminated with blood will not be analysed for total protein.

CSF samples should not be sent via the air-tube because there is evidence that in vitro haemolysis occurs when such systems are used. This will severely compromise subsequent analysis.

Fluid samples sent to Biochemistry for *?CSF leak* e.g. nasal, ear, wound, subretinal (also known as Beta trace protein, Prostaglandin D2 synthetase) **MUST** be accompanied by a serum sample so that we can send both samples to the referral laboratory in London.

5.3.1. CSF Bilirubin / Xanthochromia

Xanthochromia (CSF Bilirubin) can be detected spectrophotometrically and is available for those patients with a clinical history strongly suggestive of sub-arachnoid haemorrhage but with a negative CT scan. The lumbar puncture should be performed **at least 12 hours** after the onset of symptoms.

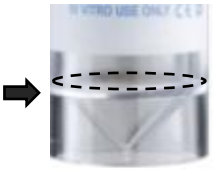
A minimum of 1.0mL of CSF is required and should be the final (third or fourth) sample collected from the tap. Additionally a concurrent clotted blood sample (brown top) should be sent as this may be needed for the interpretation of the findings.

The specimen should be sent in a plain bottle and despatched directly to biochemistry protected from light. Xanthochromia analysis is available 24 hours.

Sample Requirements

CSF Sample Collection Packs are available from Blood Sciences Specimen Reception which contain all the containers, consumables and documentation required to perform the procedure.

Perform the lumbar puncture (LP) and collect the samples in the order stated below into universal containers. Collect the concurrent blood samples. **Ensure all samples are fully labelled**.

SAMPLE	CONTAINER	MINIMUM VOLUME	ANALYSIS
CSF❶	Sterile universal	0.5ml (10 drops)[1]	Microbiology
CSF②	Sterile universal	0.5ml (10 drops) [1]	CSF Protein
CSF❸	Sterile universal	1.0ml (20 drops) [1]	Microbiology
CSF④	Sterile universal	1.0ml [1]  Fill above the meniscus line	Xanthochromia
CSF⑤	Fluoride oxalate (yellow top)	0.5ml (10 drops) [1]	CSF Glucose
Blood①	Serum gel (white/brown top)		Bilirubin/Protein
Blood②	Fluoride oxalate vacutainer (yellow top)		Glucose
State the following details on the request form:			
• Clinical Details • Date & time of onset of symptoms		• CT Scan result • Date & time CSF collection	

- Ensure all sterile universal tubes are numbered in order of collection.
- Protect samples ② & ④ from light [*wrap in foil/envelope*]
- Place CSF samples ②, ④, ⑤ & the blood samples [① & ②] in the bag for biochemistry [*ensure the request form is fully completed*].
- Place CSF samples ❶ & ❸ in the sample bag for microbiology
- Arrange immediate hand delivery to the laboratory. **DO NOT USE THE AIR TUBE SYSTEM**.

5.4. BLOOD GAS SPECIMENS

Blood gases **must** only be collected by trained personnel.

Collect minimum 1.0 mL of arterial blood into an electrolyte balanced heparinsed syringe or completely fill a capillary tube ensuring NO air bubbles present.

Ensure the syringe is labelled with the patient's full name, date of birth and NHS / Hospital number.

Blood gas samples can be sent to the laboratory via the air tube system.

5.5. MISCELLANEOUS SPECIMENS

- **Faecal** – no special requirements
- **Ascitic fluid** – no special requirements
- **Pleural fluid** for pH (non-purulent samples only) requires standard blood gas syringe and, for glucose the yellow-capped tube.
- **Gastric / duodenal fluids** – no special requirements
- **Calculi** – no special requirements

6. HEALTH & SAFETY REQUIREMENTS

6.1. HIGH RISK SAMPLES

High Risk samples can pose a risk to portering and laboratory staff especially if they are not identified appropriately by the sender.

Such samples should be clearly labelled as '*high risk'* or '*risk of infection'* or '*Danger of Infection'* on both the request card and the sample. Samples from patients who are '?Covid' or 'covid positive' should be labelled with yellow 'covid' stickers.

Sufficient clinical details (for example, IV drug user, query HIV, query CJD) should be given in the appropriate section of the request form to enable the laboratory staff to take any special precautions necessary. The warning label must be clearly visible.

It is the responsibility of the requester to indicate to the Laboratory that ALL specimens from that patient must be regarded as high risk and to supply full relevant details.

High risk samples include:

- Viral hepatitis
- HIV infection
- IV drug users
- Tuberculosis
- Creutzfeldt-Jacob disease
- Typhoid Fever (Salmonella typhi/paratyphi)
- Anthrax
- Melioidosis (Burkholderia pseudomallei)
- Brucellosis
- Coli 0157 or Haemolytic uraemic syndrome
- Dysentery (caused by Shigella dystenteriae)
- Viral Haemorrhagic Fever

The Laboratory must be notified that the samples are coming prior to collection and the request must be discussed with the relevant Consultant. All samples from these patients must be sent in the Red High Risk Transporter Boxes available from Pathology.

6.2. RADIOACTIVE HAZARDS

Radioactive samples should be retained at source until deemed safe to send to the laboratory.

It is not appropriate to transport radioactive samples across the hospital and place patients, portering staff, laboratory staff and the general public at risk of unnecessary exposure.

7. TRANSPORT OF SAMPLES

- Each specimen must be placed in a sealed transport bag for transport to the laboratory.
- All samples, unless stated, must be sent to the laboratory as soon as possible either in person or via a porter or air tube system.
- Specimens which have leaked or are not adequately identified will not be analysed.
- Avoid extremes of temperature when transporting samples to avoid sample deterioration.

7.1. Transport of Samples from GP Surgeries

The department provides a daily collection service from all GP surgeries. Samples for collection should be individually bagged then placed in a large sealed plastic bag with sufficient wadding to absorb spills.

7.2. Transport of Samples from Wards

Samples for collection should be individually bagged then placed in a large sealed plastic bag with sufficient wadding to absorb spills. The large bag should be delivered to the pathology reception by the portering staff.

7.3. Transport of Samples via Air Tube

Samples transported via the air tube must be placed in a sealed plastic sample bag with the request form in a separate pocket to the sample. Samples should be sent to Blood Science stations.

All Biochemistry blood samples may be sent via the air tube system except:

- CSF samples
- High risk samples e.g. TB, Anthrax, VHF
- Sharps
- Samples for Blood Gas Analysis
- Histopathology samples
- Large liquids >30mL such as urine or pleural washes
- Leaking samples - contamination results in tube shut down for all users until disinfection process is complete

7.4. Storage of Samples

Samples should be delivered to the laboratory the same day as collected from the patient; all ward samples should reach the laboratory within a few hours of collection.

Samples from outside the hospital that cannot be delivered that day should be centrifuged and stored in a refrigerator overnight and delivered the next morning. The refrigerator should maintain a temperature between 2^{o}C and 8^{o}C, it is especially important that the samples do not freeze.

Incorrectly stored samples may result in sample deterioration as seen by raised potassium and phosphate results for example – samples more than 8 hours old that have not been centrifuged will be rejected as they are too old for analysis.

Samples are stored for three days in the biochemistry laboratory.

8. QUALITY ASSURANCE

The Biochemistry Department is working towards accreditation with UKAS (United Kingdom Accreditation Service) (https://www.ukas.com/)

Reference Number 25461 (Date Accredited: tbc - Accreditation Certificate)

The Biochemistry Department is an accredited laboratory with the IBMS (Institute of Biomedical Sciences) (http://www.ibms.org/). This accreditation covers the training of Biomedical Scientists within the department. Date of renewal is September 2026.

8.1. TURNAROUND TIMES (TATS)

Turnaround time is the difference between time of sample receipt in the lab to the time result(s) are available to users. Requests made via Order Comms are booked into the Laboratory Information System (LIMS) as soon as they are received so the booking in time is taken as the time of receipt. Routine requests made on paper request forms are manually time-stamped on receipt and this is transcribed into the LIMS.

The time result(s) are available is defined as the time the results are electronically sent to downstream reporting systems, i.e. ICE and Careflow for users to view.

This measure does not include such factors as delays to the delivery / transport of samples to the laboratory. The department adheres to the following contractual TATs based on sample receipt to result reported times.

Source of request	Test	TAT	Target
A&E	**U&E and Trop T**	1 hour	95%
Acute / Inpatient	**U&E**	4 hours	95%
Community / GP	**U&E**	8 hours	95%

The following table gives the indicative TATs for the commonly requested biochemistry tests. Please note these may be impacted by analyser downtime, maintenance and other routine procedures.

TATS for A&E and Urgent requests	Turnaround Time
Blood Gas, Carboxyhaemoglobin (COHB)	30 Minutes
U/E, Bone, LFT, Lipids, CK, Amylase, Glucose, Gentamicin, Lactate, Vancomycin, Troponin T Paracetamol, Salicylate	60 Minutes

BHCG (inpatient, ?pregnant)	180 Minutes
Digoxin, Theophylline, Phenytoin, Carbamazepine, Lithium, Osmolality, Lactate Dehydrogenase (LD), Cortisol	240 Minutes
TATS for Ward / Routine requests	**Turnaround Time**
U/E, Bone, LFT, Lipids, CK, Amylase, Glucose	4 Hours
Digoxin, Theophylline, Phenytoin, Carbamazepine, Bile Acids, Lactate Dehydrogenase (LD), Urine tests, Iron, ACE, Lithium, Osmolality, B12, Folate	24 Hours
Cortisol, FSH, LH, FT4, TSH, Prolactin, Progesterone, PSA, Testosterone, AFP, TPO, PTH, CA markers, Hba1c, Vitamin D	3 Days
Specific Proteins, Protein electrophoresis, Paraprotein quantitation, Calprotectin, IGF-1, Free Light Chains	7 Days
Renal Calculi	14 Days
Tests referred to other laboratories	21 Days

8.2. TIME LIMITS FOR FURTHER REQUESTING OF TESTS

Further tests may be added to existing samples held in the department provided:

- The request is made within the time limits stated below
- There is sufficient sample for the test

To request additional tests send a completed '***Addition of tests form***' to the laboratory. This form is available on the Pathology intranet page: https://intranet.esneft.nhs.uk/pages/pathology

The tables below give guidance for the time limits for tests in samples already received in the laboratory which have been stored appropriately. Please note in reality samples are only stored for up to 3 days due to space constraints.

Analyte	Serum/plasma stability
ACE	7 days
AFP	7 days
Albumin	7 days
α1-antitrypsin	>7 days
ALP	7 days
ALT	7 days
Ammonia	Unstable so addition not available
Amylase	>7 days
AST	7 days
Bicarbonate	Unstable - 56 hours
Bile acids	7 days
Bilirubin – total	7 days
Bilirubin – conjugated	7 days
C3 / C4	>7 days
Ca 125	5 days
Ca 15-3	7 days
Ca 19-9	>7 days
Caeruloplasmin	>7 days
Calcium	>7 days
Carbamazepine	7 days
CEA	7 days
Chloride	>7 days
Cholesterol	7 days
Ciclosporin	N/A
Cortisol	7 days
Creatine Kinase	>7 days
Creatinine	7 days
CRP	>7 days
DHEAS	>7 days
Digoxin	>7 days
Ethanol	Unstable / addition not available
Ferritin	7 days
Folate	3 days
FSH	>7 days
FT3	3 days

Analyte	Serum/plasma stability
IGF-1	3 days
Iron	>7 days
KLC / LLC	>7 days
Lactate	3 days
LDH	3 days
LH	5 days
Lithium	7 days
Magnesium	7 days
NT-proBNP	5 days
Oestradiol	3 days
Osmolality	8 days
P1NP	>7 days
Paracetamol	>7 days
Paraprotein (PE)	3 days
Phenytoin	>7 days
Phosphate	7 days
PlGF	3 days
Potassium	>7 days
Procalcitonin	4 days
Progesterone	4 days
Prolactin	6 days
PSA	>7 days
PTH	24 hours –addition not available
Rheumatoid Factor	>7 days
Salicylate	>7 days
sFlt-1	48 hours
SHBG	3 days
Sodium	>7 days
Testosterone	7 days
Theophylline	7 days
Total Protein	>7 days
TPO	3 days
TSH	3 days
TRAB	17 hours
Transferrin	>7 days

FT4	>7 days
Gentamicin	>7 days
GGT	7 days
Glucose	7 days / addition not available on serum
Haptoglobin	>7 days
HDL	7 days
HCG	7 days
IgG / IgA/ IgM	>7 days

Triglyceride	7 days
Troponin T	7 days
Urate	7 days
Urea	7 days
Vancomycin	24 hours
Vitamin B12	3 days
Vitamin D	7 days

9. INTERPRETATION OF RESULTS

9.1. GENERAL CONSIDERATIONS

It is only possible to indicate on reports leaving the laboratory, the briefest of information on how the result presented may be interpreted. Ideally to interpret any single result on a patient, the result should be compared to the results expected in the reference population of which the patient forms a part. To identify the reference population, it may be necessary to know the patient's:

- Fasting Status
- Age
- Sex
- Posture
- Timing of menstrual cycle

Note that a reference interval will only appear on the report if age and sex of patient are stated on the request (except for babies <1 month of age). Abnormal results will be **printed in bold type**.

9.2. FACTORS AFFECTING TEST PERFORMANCE

In addition to these physiological and related factors, it is necessary to consider other major potential causes of change in analyte concentration:

- Iatrogenic influences
- Sample collection and handling from the moment of removal from the patient
- Analytical precision (Measurement Uncertainty)

Iatrogenic effects do not just include effects of the drugs which may have been prescribed for the patient's present illness, but must also take into account for example, the contraceptive pill, hormone replacement therapy for post-menopausal females, long-term diuretics, anticoagulants etc. The effect of "foodstuffs" such as caffeine, alcohol, tobacco etc. may also be relevant. A fuller account of drug interference with test results is given in the following section.

Sample collection and handling variables include tourniquet application time, ease of flow of blood into the syringe, correct specimen collection bottle, transport delays, centrifugation technique, and storage time and temperature before analysis.

The quality of the results obtained can be affected by the quality of the sample received. Blood should be collected into Sarstedt blood tubes directly by clean venepuncture with minimum cuff pressure and not filled from a syringe. After collection mix samples gently and avoid vigorous shaking. Check the expiry date of sample vials before use. These blood tubes must not have been exposed to extremes of temperature prior to collection (above 30°C).

Certain tests, such as ammonia, lactate, gut hormones, plasma amino acids for example, are best collected in the hospital to ensure minimum delay in the sample reaching the laboratory. Samples from wards should be delivered immediately to the laboratory.

Results of poor sampling will include haemolysed samples, and partially clotted samples all of which can affect the result obtained.

9.2.1. Drug Interference with Test Results

Many drugs and some natural metabolites may affect results in one of two ways:

- **Direct interference** with the laboratory test procedure yielding a higher or lower apparent result for the requested analyte - the in vitro effect. This type of interference is method specific and most are well known and readily recognisable.
- **Indirect Interference** - by provoking a change in the analyte to be measured through physiological, pharmacological or toxicological processes in the patient - the in vivo effect. This type of interference is more important as it accounts for approximately 75% of all known cases of interference and is more difficult to identify.

If there is any doubt about the validity of an analytical result, please check with the laboratory (ext.2415) to discuss possible drug interference.

9.2.2. Biotin interference

Please note that a high biotin intake can cause interference with some immunoassay results.

This includes the following tests: AFP, CA 125, CA 15-3, CA19-9, CEA, cortisol, ferritin, folate, hCG, LH, oestradiol, PTH, procalcitonin, progesterone, prolactin, TSH, troponin T and vitamin B12.

Patients taking biotin doses >5 mg/day should wait at least 8 hours before a sample is taken. If in doubt, please contact the laboratory.

9.2.3. Analytical imprecision (Measurement Uncertainty)

Biochemical tests are subject to a degree of uncertainty in their measurement. This may be due to a variety of factors including

- Biological variation within individuals
- Analytical measurement imprecision
- Pre-analytical factors

Please contact the laboratory staff if you wish to discuss uncertainty of measurement for analytes measured in the department.

9.3. REFERENCE RANGES

All numerical results have reference ranges printed on the report with the result. Reference ranges may be sex and age related.

See section 12. TEST LIST & SAMPLE REQUIREMENTS for specific test sample requirements

NOTE: Paediatric and gender reference values may be different from adult ranges contact department for details.

9.4. TELEPHONING RESULTS

Please note that we need to establish the caller's identity before giving results over the telephone. We cannot give results to patients or their relatives. We can only provide results to medical practitioners or their authorised deputies.

Very abnormal / critical results, if not previously abnormal will be telephoned in accordance with departmental and RCPath guidelines. The following results are telephones

- Glucose: ≤2.5 & ≥25.0 mmol/L
- Potassium: ≤2.6 mmol/L or ≥6.0 mmol/L
- Magnesium: ≤0.40 mmol/L
- Sodium: ≤120 mmol/L and ≥160 mmol/L

10. BIOCHEMISTRY SERVICES

10.1. PROTEINS

Assays available within ESNEFT laboratories:

- Immunoglobulins: IgG, IgA, IgM
- Carrier proteins: Albumin, Caeruloplasmin
- Acute phase proteins: C-reactive protein (CRP)
- Serum and urine protein electrophoresis, including Bence Jones protein
- Kappa and Lambda free light chains
- Identification and quantitation of paraproteins in serum and urine using immunofixation
- Detection of cryoglobulins and macroglobulinaemia
- Urine microalbumin

Principal Applications

Immunoglobulins:	monitoring immune competence
Albumin:	hypoalbuminaemia is a reliable indication of illness but has little diagnostic specificity. It is, however, important in assessing calcium and magnesium status.
Caeruloplasmin:	Wilson's disease
C-reactive protein:	acute and chronic inflammation
Protein electrophoresis:	used for the diagnosis of patients suspected of having B-cell malignancy or in the monitoring of such patients. More specific assays should be requested in other clinical situations.

Sample Requirements

- 7.5 mL clotted blood (B) for any serum measurement.
- Clotted blood for cryoglobulins must be collected into a warm brown-topped monovette tube and kept at 37^{o}C during transit to the laboratory, where possible an appointment should be made in the phlebotomy clinic.
- Urine protein assays and microalbumin / creatinine ratio require an early morning urine (30 mL) collected into a white screw-capped plastic container. (No preservative).

10.2. BLOOD LIPID STUDIES

Assays available at Colchester

- Cholesterol, HDL cholesterol, LDL cholesterol, Triglycerides

Principal Applications

- Coronary risk assessment
- Dyslipoproteinaemias

Sample Requirements

- For cholesterol / HDL cholesterol - fasting is NOT required 7.5 mL blood (B)
- Other assays - fast for 12-14 hrs (not less, not more) 7.5 mL blood (B)

Notes

- Serum triglycerides are subject to major increases following meals and may also be released (as VLDL) after prolonged fasting: the 12-14 hour fast for meaningful triglyceride measurements is therefore critical.
- Cholesterol levels can exhibit a seasonal variation and there may be marked day-to-day variations in certain individuals. Serum cholesterol measurements during admission for myocardial infarction can be misleading due to marked but variable decreases in the circulating cholesterol level. Assessment/re-assessment of cholesterol status should be postponed to 3 months post-infarct.

10.3. ENDOCRINOLOGY

Assays available within ESNEFT laboratories:

- IGF-1
- Free T4
- TSH
- Free T3
- FSH
- LH
- Progesterone
- Prolactin
- Cortisol
- Testosterone
- SHBG
- Estradiol
- Parathyroid Hormone (PTH)
- DHEAS

Some of these assays may be carried out as part of dynamic function tests. Further information can be obtained from that section of this handbook or from the Biochemistry Department - Ext.2415.

Sample Requirement(s)

- 7.5 mL clotted blood (B) is sufficient for any desired combination of assays
- PTH assays require a blood 3.4 mL (R) as well as 7.5 mL clotted blood (B)

10.4. TROPONIN GUIDELINES

Troponin T (TnT) is a component of the contractile apparatus of the striated musculature. TNT originating exclusively from the myocardium clearly differs from skeletal muscle TNT. As a result of its high tissue specificity, cardiac troponin T (c TNT) is a cardio-specific, highly sensitive marker for myocardial damage.

Cardiac troponin T (cTNT) is an independent prognostic marker which can predict the near, mid and even long term outcome of patients with acute coronary syndrome (ACS). Cardiac troponin T is also useful to identify patients that benefit from anti-thrombotic therapy (GPIIb /IIIa inhibitors, low molecular weight heparin).

Low concentrations of troponin T can be detected in clinically stable patients such as patients with ischaemic or non-ischaemic heart failure, patients with different forms of cardiomyopathy, renal failure, sepsis and diabetes.

Elevated levels of troponin T correlate with the severity of coronary artery disease and to poor outcome independent of natriuretic peptide (BNP or NT-pro BNP) levels.

Myocardial cell injury leading to elevated cTNT concentrations in the blood can also occur in other clinical conditions such as myocarditis, heart contusion, atrial fibrillation, pulmonary embolism and drug induced cardiotoxicity.

Current Criteria of Interpretation of Results:

- Results to be considered with all other criteria necessary to diagnose myocardial infarction (MI)
- 2 samples are required, 6 hours apart. Peak sample:

  a**) <14 ng/L Negative,**
  b) 14 - 100 ng/L Intermediate (an increment between the samples of > 7 is suggestive of MI),
  c) >100 ng/L High probability.

10.5. THERAPEUTIC DRUG MONITORING (TDM)

Assays available on site:

- Carbamazepine
- Digoxin
- Lithium
- Phenytoin
- Theophylline
- Gentamicin
- Vancomycin
- Ciclosporin
- Phenobarbitone and Valproate are available but are sent to referral laboratories.

Principal Applications

- Monitoring of serum levels of those drugs for which there is an established therapeutic window range of serum concentrations between levels that are ineffective and levels which are toxic.
- Valproate is only of value in assessing patient compliance.

Sample Requirements

- Digoxin - 7.5 mL blood (B) collected at least 6 hours post-dose or pre-dose
- All other drugs listed - immediately before a dose.
- State dosage details (dose, time of last dose and time sample collected) on the request form.

See section 12. TEST LIST & SAMPLE REQUIREMENTS for specific test sample requirements

Optimal Therapeutic Serum Concentrations:

Carbamazepine	4.0 - 12.0 mg/L
Phenytoin	5.0 - 20.0 mg/L
Theophylline	10.0 - 20.0 mmol/L
Digoxin	0.5 - 2.0 mmol/L
Lithium	0.4 - 1.0 mmol/L

NOTES

The serum concentration may not necessarily reflect the pharmacological effects in any one particular patient as the pharmacokinetics depend upon many factors, including hepatic and renal function, concurrent drug therapy, and the nature of the bio-active drug. In consequence, the TDM service is supported by the Pharmacy Department who will advise on the interpretation and action in relation to any specific result.

It is advisable that a serum creatinine estimation be requested at the same time as digoxin, lithium and gentamicin levels, so that current renal function can be assessed if it is not already known.

The availability of a TDM service does not imply that every patient on the drug concerned should be monitored. It is particularly important that requests are limited to the comparatively small number of occasions when they are of clinical value.

10.6. TOXICOLOGY AND DRUG SCREENING

Assays available on site:

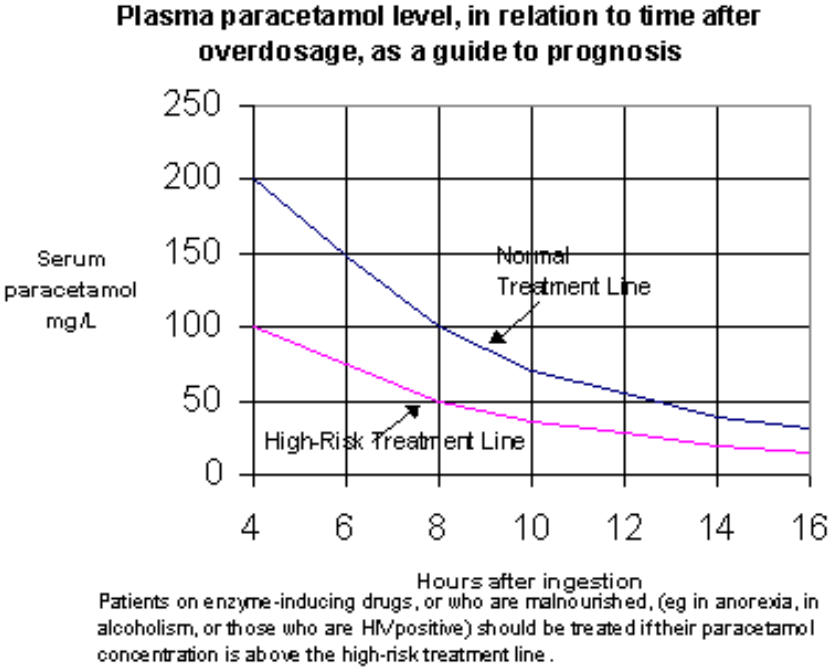
- Salicylate
- Paracetamol
- Carboxyhaemoglobin
- Ethanol (clinical, not medico-legal)

Sample Requirements

Paracetamol & Salicylate	7.5 mL clotted blood (B) Take at least four hours after ingestion and record the time of ingestion
Ethanol	7.5 mL blood in plain tube (B)
Carboxyhaemoglobin	3.4 mL blood in EDTA (R) or heparinised (O) tube

Interpretation

- **Salicylate:** Poisoning can produce profound metabolic disturbances. Salicylate may be released from the tissues sometime after ingestion. Check the blood level after 4 hours if it is thought that toxic levels might be reached.
    - Toxic Levels: Child >300 mg/L
    - Toxic Levels: Adult >500 mg/L
    - Potentially Lethal: 700 mg/L
- **Paracetamol:** Patients whose plasma paracetamol concentrations are above the normal treatment line on the nomogram should be treated with acetylcysteine by intravenous infusion (or, provided the overdose has been taken within 10-12 hours, with methionine by mouth).



Patients on enzyme-inducing drugs (e.g. carbamazepine, phenobarbitone, phenytoin, and alcohol) or who are malnourished (e.g. in anorexia, in alcoholism, or those who are HIV-positive) should be treated if their plasma-paracetamol concentrations are above the high-risk treatment line.

- **Alcohol:** Toxic >150 mg/dL
- **Carboxyhaemoglobin:**

	% of total haemoglobin
Suburban non-smokers	1.5
Smokers	1.5 - 5.0
Heavy smokers	5.0 - 9.0
Severe poisoning	>50

10.6.1. Other Drug Overdoses

It is not practical for the laboratory to screen for all poisons. Further treatment, advice and analytical services can be obtained by contacting the POISONS UNIT (New Cross) at GUY'S HOSPITAL (020 7771 5370 or #6 358) through the hospital switchboard operator. Note, however, that not all assays suggested by this unit are available (or indeed necessary)

In all suspected overdose cases, the following samples should be collected:

- **Urine in a 30 mL white container**
- **10mL clotted blood**
- **gastric aspirate (where available) to be sent to the laboratory for storage and possible later analysis.**

The Biochemistry Department does not undertake monitoring of patients on **restricted drugs or suspicion of addiction**. A service for this is available through a laboratory operated by the Community Drug Team. Samples should be sent direct to the laboratory at 37 Berner's Street, Ipswich, NOT via the Biochemistry Department.

10.7. TRACE METALS

- Lead
- Magnesium – available on site at Colchester
- Zinc
- Copper
- Selenium
- Cobalt
- Chromium

Principal Applications

- **Copper and Zinc**: Suspected deficiency due to inadequate dietary intake, particularly in patients receiving parenteral nutrition, with malabsorption, or as a result of excessive losses. Measurements of serum copper together with caeruloplasmin are indicated for the diagnosis of suspected Menke's syndrome (rare) and Wilson's disease.
  Urinary copper excretion is only of value in the investigation of Wilson's disease.

- **Lead**: Blood lead measurement is required for assessment of exposure to inorganic lead as 95% of blood lead is bound to erythrocytes.
  Measurement in urine is required for assessment of exposure to organic lead derivatives.

- **Magnesium**: Suspect deficiency due to poor intake, decreased absorption, or increased loss.

Sample Requirements

With a few exceptions. samples for trace metal analysis are usually collected in a special Sarstedt Monovette 7.5ml Lithium Heparin (Orange top) for Trace Metal analysis.

Other trace metal assays are available - contact Ext. 2415 or See section 12. TEST LIST & SAMPLE REQUIREMENTS for specific test sample requirements

11. TESTS REFERRED TO OTHER LABORATORIES

Tests not available at Colchester are referred to other UKAS accredited laboratories (where possible). These include:

- Immunologically important proteins and tumour markers
- Metals
- Vitamins
- Therapeutic Drugs
- Genetic enzymes

See section 12. TEST LIST & SAMPLE REQUIREMENTS for specific test sample requirements

although this is not exhaustive; it is neither possible nor appropriate to give a full list of individual analytes. If you believe that the assay you require might be referred, contact the laboratory.

Sample Requirements

Many of the substances to be measured are labile and special collection/transport arrangements are needed. Contact the laboratory before you collect any such sample.

A request form must be fully completed. In all cases give adequate information and indicate current medication. If you think that it might be helpful, write a brief covering letter (in certain instances you may be asked for such a letter anyway).

Reference intervals are always stated on reports.

Notes

Referred services can only be contacted through the laboratory - requests are not accepted directly from individual clinicians.

In addition to referred services, the laboratory is often able to arrange for other special investigations to be undertaken by colleagues in other clinical biochemistry laboratories. We are always interested to hear of unusual biochemical problems and may well be able to assist with their investigation - telephone ext. 2415 to discuss the problem.

12. TEST LIST & SAMPLE REQUIREMENTS

Sample requirements are listed showing the recommended collection tube. In some instances alternative tubes may be used, e.g. the full range of tubes is available for paediatric samples.

The volumes indicated are to identify the correct tube only and do not imply that more than one Monovette is required for a selection of tests.

If in doubt about minimum volumes or sample types, contact the laboratory to discuss (Ext. 2415).

Samples are collected using the Sarstedt Monovette system in the following containers:

(B)	**Brown top**	**Clotted sample**
(W)	**White top**	**Clotted sample - no separating gel**
(R)	**Red top**	**EDTA**
(O)	**Orange top**	**Lithium heparin**
(Y)	**Yellow top**	**Fluoride**

NOTES:

- The majority of analyses are performed on serum using the brown 7.5 mL Sarstedt tubes, unless otherwise stated.
- The reference intervals given are for adults. Note that some intervals vary with age and sex. The intervals below are for guidance only as all printed reports contain the appropriate age/sex related intervals.
- The intervals quoted are intended as a guide only, and should not be regarded as rigid limits.
- Reference intervals for the less common tests are available from the laboratory, and are given on the hard copy reports.
- For information on assays or for clinical reference use: http://labtestsonline.org.uk/

Test / Analyte	Sample requirements	Reference Range and General Comments
Acyl Carnitine	4x blood spots (Guthrie Card)	
Adrenocorticotrophic Hormone (ACTH)	Blood 2 x 3.4 ml (R) Send to laboratory immediately on ice	0 - 49 ng/L (9am)
Adalimumab profile	Blood 7.5 ml (B) Indicate when last dose given	Descriptive report
Alanine Transaminase (ALT)	Blood 7.5 ml (B)	Males: 0-41 U/L Females: 0-33 U/L
Albumin (ALB)	Blood 7.5 ml (B)	35 - 50 g/L
Albumin / Creatinine ratio (ACR)	Random urine	0 – 2.5 mg/L
Aldosterone	Blood 3.4 ml (R) – patient must be rested for 15mins. Send to laboratory immediately	Descriptive report Separate tube for renin if required
Alkaline Phosphatase (ALP)	Blood 7.5 ml (B)	30 - 130 U/L (age/sex related)
Alkaline Phosphatase Isoenzymes	Blood 7.5 ml (B)	Descriptive report
Alpha-1 Antitrypsin (A1AT)	Blood 7.5 ml (B)	0.9 - 2.0 g/L
Alpha 1 anti-Trypsin Phenotype	Blood 7.5 ml (B)	Descriptive report

Alpha Fetoprotein (AFP)	Blood 7.5 ml (B)	<5.8 kU/L
Aluminium (AL)	Blood 7.5ml (O) LH Trace Metal Tube	<0.4 µmol/L
Amino Acids (plasma)	Blood 1.2 ml (O) - send to lab immediately	Descriptive report
Amino Acids (CSF)	CSF in plain universal tube	Descriptive report
Amino Acids (urine)	Random urine	Descriptive report
Amiodarone	Blood 3.4 mL (R) State current medications	0.5 - 2.0 mg/L (pre- dose)
Ammonia (NH3)	Blood 1.3 ml (R) - contact lab BEFORE sample collection and transfer sample to lab within 30 mins on ice. Retrospective requesting not available	Females 11 – 51 µmol/L Males 16 – 60 µmol/L Child (29days – 16yrs) 0 – 50 µmol/L Neonate (0 – 28 days) 0 – 100 µmol/L Sick/premature neonate 0 – 150 µmol/L
Amylase (AMY)	Blood 7.5 ml (B)	28 - 100 U/L
Androstenedione (AND)	Blood 7.5 ml (B)	Contact the laboratory
Angiotensin Converting Enzyme (ACE)	Blood 7.5 ml (B) Samples MUST be separated from cells within 4 hrs of venepuncture.	8 - 65 U/L
Anion Gap	Blood 7.5 ml (B)	
Anti Mullerian Hormone (AMH)	Blood 7.5 ml (W) or (B) Spin and freeze within 4hrs.	
Anti-SARS-CoV-2 (Nucleocapsid)	Blood 7.5mL (B)	
Anti-SARS-CoV-2 (Spike)	Blood 7.5mL (B)	
Apolipoproteins	Blood 7.5 ml (B)	
Aripiprazole	Blood 3.4 ml (R) - 12 h post dose Record dosage and sample date/time.	
Arsenic	Blood 7.5ml (O) LH Trace Metal Tube or plain random urine. Patient must not eat seafood for 5 days prior	Blood: < 95 nmol/L 24hr Urine: < 534 nmol/24hr Random Urine: <12.9 nmol/mmol creat
Aspartate transaminase (AST)	Blood 7.5 ml (B)	Males: 0 - 40 U/L Females: 0 - 32 U/L
Beta-2 Microglobulin (B2M)	Blood 7.5 ml (B)	1.2-2.4 mg/L
Beta-HCG (? ectopic preg /T Marker)	Blood 7.5 ml (B)	0 – 5 U/L
Beta-Hydroxybutyrate (BHB)	Blood 1.2 ml (O) - send to lab immediately	
Bicarbonate (serum)	Blood 7.5 ml (B)	22 - 29 µmol/L
Bile acids	Blood 7.5 ml (B)	<10 µmol/L
Bilirubin (conjugated)	Blood 7.5 ml (B)	<5 µmol/L
Bilirubin (total)	Blood 7.5 ml (B)	<21 µmol/L
Biotinidase	Blood 1.2 ml (O) - send to lab immediately	
Blood Gas	Blood (PICO syringes) - 1.0 ml of	

	arterial blood into heparinised syringe or capillary with no air bubbles present - send to lab immediately	
BNP (NT pro-BNP)	Blood 7.5 ml (B)	Normal levels <400 pg/mL Elevated levels 400-2000 Very high levels >2000
CA12-5	Blood 7.5 ml (B)	0 - 35 U/mL
CA15-3	Blood 7.5 ml (B)	<28.5 kU/L
CA19-9	Blood 7.5 ml (B)	0 - 34 U/mL
C Peptide	Blood 7.5 ml (B) and 4.9 ml (Y) Send to laboratory immediately	Descriptive report
C Reactive Protein (CRP)	Blood 7.5 ml (B)	0 - 5 mg/L
Cadmium	Blood 7.5ml (O) LH Trace Metal Tube	Non-smoker < 27 nmol/L Smoker < 54 nmol/L
Caeruloplasmin	Blood 7.5 ml (B)	0.20 - 0.50 g/L
Calcitonin	Blood 7.5 ml (B) - preferably fasting - Send to lab immediately	
Calcium (adjusted for albumin)	Blood 7.5 ml (B)	>17 years 2.20 - 2.60 mmol/L
Calcium	Blood 7.5 ml (B)	>17 years 2.20 - 2.60 mmol/L
Calcium (urine)	Random urine	2.50 - 7.50 mmol/L
Calcium (24hr urine)	24 hr urine	2.5 - 7.5 mmol/d
Calculus		
Calprotectin	Random faeces	0-50 µg/g faeces
Carbamazepine	Blood 7.5 ml (W) – collect prior to dose	4.0 - 12.0 mg/L
Carbamazepine-epoxide	Blood 7.5 ml (W) Record dosage and sample date/time	Up to 2.3mg/L
Carbohydrate Deficient Transferrin (CDT)	Blood 7.5 ml (B)	CDT = < 1.6% - No excess alcohol intake CDT = 1.6-1.9% - Intake may be high but not necessarily in the range of dependence CDT = ≥ 2.0% - Excess alcohol intake
Carboxyhaemoglobin (COHB)	Blood 7.5 mL (O)	Non Smoker 0.5 - 1.5% total Hb Smoker: 1.5 - 5.0 % total Hb
Carcino-embryonic Antigen (CEA)	Blood 7.5 ml (B)	0 - 4.7 ng/mL
Carotene	Blood 3.4 ml (R) or (O) Protect from light.	Contact the laboratory
Carnitines (plasma)	Blood 1.2 ml (O) Send to lab immediately	Total: 26 – 62 µmol/L. Free: 22 – 50 µmol/L. Acyl: 4 – 12 µmol/L.
Chloride	Blood 7.5 ml (B)	95-108 mmol/L
Chloride (sweat)	Sweat	Sweat chloride < 30 mmol/L is normal - low probability of Cystic fibrosis
Chloride (urine)	24 hr urine	110 - 250 mmol/d
Cholesterol	Blood 7.5 ml (B)	
Cholesterol (HDL)	Blood 7.5 ml (B)	0.9 - 1.45 mmol/L
Cholesterol (LDL)	Blood 7.5 ml (B)	<4.0 mmol/L
Cholinesterase (incl. phenotype)	Blood 7.5 ml (B) If genotype required send (R) EDTA	Descriptive report

Cholinesterase (organo-phosphate poisoning)	Blood 3.4 ml (R)	Descriptive report
Chromium	Blood 7.5ml **(O) LH Trace Metal Tube**	Contact the laboratory
Chromogranin A	Blood 2 x 3.4 ml (R) **Patient must be fasting**. Send to laboratory immediately.	0-60 pmol/L
Chromogranin B (GAWK)	Blood 2 x 3.4 ml (R) **Patient must be fasting**. Send to laboratory immediately.	0-150 pmol/L
Citrate (urine)	24 hr urine with hydrochloric acid preservative.	Contact the laboratory
Clobazam	Blood 7.5 ml (W)	Record dosage and sample date/time
Clonazepam	Blood 7.5 ml (W)	Record dosage and sample date/time
Clozapine	Blood 3.4 ml (R)	AED - Record dosage and sample date/time
Cobalt	Blood 7.5ml **(O) LH Trace Metal Tube**	0 - 17 nmol/L
Complement C3	Blood 7.5 ml (B)	0.9 – 1.8 g/L
Complement C4	Blood 7.5 ml (B)	0.1 – 0.4 g/L
Copper (CU)	Blood 7.5ml **(O) LH Trace Metal Tube**	11.0–25.0 mmol/L Age related ranges
Copper (urine)	24 hr urine	24 hr urine • Normal <0.7µmol/24hr • Wilsons disease >1.8µmol/24hr
Cortisol	Blood 7.5 ml (B) - state time of collection.	9am Cortisol 155 - 605 nmol/L Midnight Cortisol 40 - 210 nmol/L
Covid19 Antibody(Spike)	Blood 7.5 ml (B)	
Creatinine	Blood 7.5 ml (B)	59 - 104 µmol/L (Adult males) 45 - 84 µmol/L (Adult females)
Creatinine (urine)	24 hr urine	Males: 3.54 - 24.6 mmol/d Females: 2.55 - 20.0 mmol/d
Creatine Kinase (CK)	Blood 7.5 mL (B)	Males: 40 - 320 U/L Females: 25 - 200 U/L
CK Isoenzymes	Blood 7.5 ml (B)	Descriptive report
Cryoglobulin (CRYO)	2x Blood 7.5 ml (W) and 2x 3.4 mL (R). Collect samples into pre-warmed tubes kept at 37°C. Take samples to laboratory immediately and should be received before 3pm Mon-Fri.	Positive / Negative
CTX Beta Crosslaps	Blood 3.4 ml (R) – fasting Send to laboratory immediately	
Cyclosporin	Blood 3.4 ml (R) >12 hrs post dose	70 - 180 µg/L
Cystine	Random or 24 hr urine	Positive / Negative
Dehydroepiandrosterone sulphate (DHEAS)	Blood 7.5 ml (B)	19-24 yrs = 1.77-9.99 µmol/L 24-34 yrs = 4.02-11.0 µmol/L

		34-44 yrs = 2.68-9.23 µmol/L 44-54 yrs = 1.65-9.15 µmol/L 54-64 yrs = 0.96-6.95 µmol/L 64-74 yrs = 0.51-5.56 µmol/L 74-120 yrs = 0.26-6.68 µmol/L
7-Dehydrocholesterol	Blood 3.4 mL (R)	
11 deoxycortisol	Blood 7.5 ml (B)	Contact laboratory
Digoxin	Blood 7.5 ml (B) - collect 6 hr post dose	0.5 - 2.0 µg/L If results are unexpectedly high, consider digoxin-like immunoreactive substance (DLIS) cross-reactivity.
Dihydropyrimidine dehydrogenase	Blood 3.4 ml (R)	
Dihydrotestosterone (DHT)	Blood 7.5 ml (B)	Contact laboratory
Disopyramide	Blood 7.5 mL (B)	Contact laboratory
Drug screen	Random urine	Descriptive report
Drugs of abuse	Random urine	Consent required for all <16 yrs
eGFR	Blood 7.5 ml (B)	
Elastase (faecal)	Random stool	>200 µg/g
Enhanced liver fibrosis (ELF)	Blood 7.5 ml (W)	
Eslicarbazepine	Blood 7.5 ml (W) Record dosage and sample date/time	3 - 35mg/L
Ethanol (Alcohol)	Blood 7.5 ml (B)	Postmortem / clinical samples only.
Ethosuximide	Blood 7.5 ml (W) Record dosage and sample date/time	40 - 100 mg/L
Ethylene Glycol	Blood 4.9 ml (Y)	Contact department before requesting
Fabry's Disease (α-Galactosidase)	Blood 3.4 ml (R) - Send to lab before 12 noon Mon – Weds only.	
Ferritin	Blood 7.5 ml (B)	Males: 20-60yrs 30 - 400 ng/mL Females: 17-60yrs 13 - 150 ng/mL
Flecainide	Blood 3.4 mL (R)	0.15 - 0.9 mg/L
Folate	Blood 7.5 ml (B)	<3 µg/L suggests deficiency
Follicle Stimulating Hormone (FSH)	Blood 7.5 ml (B) - state date of last menstrual period if known.	Follicular phase: 3.5 - 12.5 U/L Ovulation phase :4.7 - 21.5 U/L Luteal Phase: 1.7 - 7.7 U/L Menopausal: 25.8 – 134.8 U/L Males: 1.5 - 12.4 U/L
Free Androgen Index (FAI)	Blood 7.5 ml (B)	Calculated from Testosterone and Sex Hormone Binding Globulin
Free Fatty Acids	Blood 1.2 ml (O) - send to lab immediately	
Free Light Chains (FLC)	Blood 7.5 ml (B)	Kappa light chains 3.30-19.40 mg/L Lambda light chains 5.71-26.30 mg/L Kappa:Lambda ratio 0.26-1.65
Free T3	Blood 7.5 ml (B)	3.1 – 6.8 pmol/L
Free T4 (Thyroxine)	Blood 7.5 ml (B)	12.0 – 22.0 pmol/L
Free testosterone	Blood 7.5 ml (B)	
Fructosamine	Blood 7.5 ml (B)	<285 µmol/L

Fructose-1,6-bisphosphatase	Blood 7.5 ml (O) - Mon or Weds only	
Gabapentin	Blood 7.5 ml (W) Record dosage and sample date/time	2- 20mg/L
Galactokinase	Blood 7.5 ml (O)	
Galactosidase	See white cell enzymes	
Galactose-1-Phosphate Uridyl Transferase (GAL-1-PUT)	Blood 1.3 ml (O)	Descriptive report
Gamma Glutamyl Transferase (GGT)	Blood 7.5 ml (B)	Males: 0 - 60 U/L Females: 0 - 40 U/L
Gastrin	Blood 2 x 3.4 ml (R) Send to laboratory immediately.	0 - 40 pmol/L
Gaucher Disease (β-Glucosidase)	Blood 3.4 ml (R) - Send to laboratory before 12 noon Mon – Weds only.	
Gentamicin	Blood 7.5 ml (B)	
Globulin (GLOB)	Blood 7.5 ml (B)	17 - 35 g/L
Glucagon	Blood 2 x 3.4 ml (R) Send to laboratory immediately on ice.	0 - 50 pmol/L
Glucose	Blood 4.9 ml (Y)	3.0 - 6.0 mmol/L = fasting
Glucose (CSF)	CSF 2.7 mL (Y)	approx 60% pof plasma concentration
Glucose Tolerance Test (GTT)	2x Blood 4.9 ml (Y)	Sample 1 collected immediately before glucose load. Sample 2 collected 2h later.
Glycosaminoglycans (GAGS) (mucopolysaccharides)	Random urine	
Growth Hormone (GH)	Blood 7.5 ml (B)	Contact laboratory
Guanidinoacetate	Blood 1.2 ml (O) - send to lab immediately with paired random urine	
Gut Hormones	Blood 2 x 3.4 ml (R) - **Patient must be fasting.** Send to laboratory immediately.	
Haemoglobin A1c (HbA1c)	Blood 3.4 ml (R)	Non-Diabetic 20-45 mmol/mol Diabetic ideal control 48-58 mmol/mol
Haptoglobin	Blood 7.5 ml (B)	Male: 0.5 - 2.0 g/L. Female: 0.4 - 1.6 g/L.
Homocysteine (investigation of arteriosclerosis risk)	Blood 7.5 ml (O) - send to lab immediately	Contact laboratory
5-Hydroxy-indole-acetic acid (5HIAA) (plasma)	Blood 7.5 ml (O) Overnight fast - avoid bananas, walnuts, pineapples, tomatoes, plums, avocado before collection	27 - 70 nmol/L.
5-Hydroxy-indole-acetic acid (5HIAA) (urine)	24hr urine with glacial acetic acid preservative	<50 µmol /24 hours

17 Hydroxyprogesterone (bloodspot)	6 x blood spots, special card required - contact laboratory	
17 Hydroxyprogesterone (serum)	Blood 7.5 ml (B)	Male(> 16y M+F): <5.0 Female: Adult (> 16y M+F): <5.0 Neonates (>48h after birth) 5d: <3.0. < 16y M+F : <4.0 Adult female results may be higher in luteal phase of menstrual cycle
Hydroxyproline	24hr urine	Contact laboratory
Immunoglobulin A (IgA)	Blood 7.5 ml (B)	Age/sex related, contact laboratory
Immunoglobulin G (IgG)	Blood 7.5 ml (B)	Age/sex related, contact laboratory
Immunoglobulin M (IgM)	Blood 7.5 ml (B)	Age/sex related, contact laboratory
Immunoglobulin G Subclasses	Blood 7.5 ml (B)	Age/sex related, contact laboratory
IgE Specific (RAST)	Blood 7.5 mL (B)	
IgE Total	Blood 7.5 mL (B)	
Inhibin B	Blood 7.5 ml (B)	
Insulin	Blood 7.5 ml (B) and 4.9 ml (Y) Send to laboratory immediately	See descriptive report
Insulin-like growth factor (IGF-1)	Blood 7.5 ml (B)	Age/sex related, contact laboratory
IGF Binding Protein (IGF-BP3)	Blood 7.5 ml (B)	Age/sex related, contact laboratory
Infliximab profile	Blood 7.5 ml (B)	
Interference studies for TFT	Blood 7.5 ml (B) x2	
Iron (Fe)	Blood 7.5 ml (B)	Males: 11.0 - 28.0 µmol/L Females: 6.6 - 26.0 µmol/L
ISAC allergen screen	Blood 7.5 ml (B)	
Lacosamide	Blood 7.5 ml (W) Record dosage and sample date/time	10 - 20 mg/L
Lactate	Blood 4.9 ml (Y) - send to lab within 15mins	0.5 - 2.2 mmol/L
Lactate (CSF)	CSF 2.7 mL (Y)	1.1 - 2.4 mmol/L
Lactate Dehydrogenase (LDH)	Blood 7.5 ml (B)	Females: 135 – 214 U/L Males: 135 - 225 U/L
Lamotrigine	Blood 7.5 ml (W) Record dosage and sample date/time	3 - 15 mg/L
Lead (Pb)	Blood 7.5ml (O) LH Trace Metal Tube	<0.24 µmol/L
Levetiracetam (Keppra)	Blood 7.5 ml (W) Record dosage and sample date/time	12 - 46mg/L
Lipase	Blood 7.5 ml (B)	5 - 51 IU/L
Lipoprotein (a) / electrophoresis	Blood 7.5 mL (W)	Free text
Lithium (LI)	Blood 7.5 ml (B)	0.4 - 1.0 mmol/L
Lutenising Hormone (LH)	Blood 7.5 ml (B) - state date of last	Follicular phase 2.4 - 12.6 U/L

	menstrual period if known.	Ovulation phase 14.0 - 95.6 U/L Luteal phase 1.0- 11.4 U/L Peri-Menopausal 7.7 - 58.5 U/L Male 1.7 - 8.6 U/L
Lysosomal enzymes (Fabry's, Pompe's and Gaucher's)	Blood 1.2 ml (O) - send to laboratory before 12 noon Mon or Weds	Descriptive report
Macroprolactin	Blood 7.5 ml (B)	
Magnesium	Blood 7.5 ml (B)	0.7 - 1.0 mmol/L
Manganese (MN)	Blood 7.5ml (O) LH Trace Metal Tube	Blood: 80 - 260 nmol/L
Maternal Serum Screen (Triple test)	Blood 7.5 ml (W)	Descriptive report
Mercury (blood)	Blood 7.5ml (O) LH Trace Metal Tube	
Mercury (urine)	Random early morning urine or 24 hr collection	
Metanephrines (plasma)	Blood 3.4 ml (R) - Send to laboratory immediately.	Metanephrine: 80 – 510 pmol/L Normetanephrine: 120 – 1180 pmol/L 3-methoxytyramine: <120 pmol/L
Metanephrines (urine)	24 hr urine collection	Normetadrenaline <4400 nmol/24h Metadrenaline <2000 nmol/24h 3-Methoxytyramine <2500 nmol/24h
Methaemoglobin	Blood 7.5 ml (O)	<1.5 %Hb
Methanol	Blood 4.9 ml (Y) - contact laboratory before taking sample	
Methotrexate	Blood 7.5 ml (B)	
Methylmalonic Acid	Blood 7.5 ml (B)	≤65 yrs <280 nmol/L >65 yrs <360 nmol/L
Micronutrient Screen	Blood 2 x 7.5 ml (W) - protect from light	
Mucopolysaccharide disorders (Tay Sachs)	Blood 7.5 ml (O) - Mon or Weds only	
Mycophenolate (MPA)	Blood 3.4 ml (R) - 12h pre-dose	
Myeloma Screen	Blood 7.5 ml (B)	
Nickel	Blood 7.5ml (O) LH Trace Metal Tube	7.5 - 21.5 nmol/L
Occult blood (FIT)	Random faeces	<10 µg Hb/g faeces
Oestradiol (E2)	Blood 7.5 ml (B)	Follicular phase: 114 - 332 pmol/L Luteal phase: 222 - 854 pmol/L Ovulation phase: 222 - 1959 pmol/L Post menopause: <18 - 505 pmol/L Males: 41 - 159 pmol/L
Olanzapine	Blood 3.4 mL (R)	
Oligoclonal Bands	Blood 7.5 ml (B) and CSF	Qualitative reports depending on band patterns
Osmolality	Blood 7.5 mL (B)	280 - 295 mOsm/kg
Osmolality (urine)	Random urine	Depends on clinical scenario
Oxcarbazepine (Trileptal)	Blood 7.5 ml (W)	
Oxalate (urine)	24 hr urine	Males: 0.08-0.49 mmol/d Females: 0.04-0.34 mmol/d
pCO2 (arterial)	Blood (PICO syringes) - send to lab	Females: 4.3-6.0 kPa

	immediately	Males: 4.7-6.4 kPa
pH (arterial)	Blood (PICO syringes) - send to lab immediately	7.35-7.45
pO2 (arterial)	Blood (PICO syringes) - send to lab immediately	11.0-14.4 kPa
Pancreatic polypeptide (see Gut Hormones)	Blood 2 x 3.4 ml (R) - Send to laboratory immediately.	<300 pmol/L
Paracetamol	Blood 7.5 ml (B) - collect > 4 hr post ingestion.	See nomogram
Parathyroid hormone (PTH)	Blood 3.4 ml (R) and 7.5 ml (B) Send to lab within 8 hours	1.6 - 6.9 pmol/L
PTH related peptide (PTHrP)	Special EDTA (with Trasylol) bottle - Contact laboratory before collection	
Paraprotein	Blood 7.5 mL (B)	Descriptive report
Paraprotein (urine)	Random urine	Descriptive report
Paraquat	Random urine	Positive / Negative
Phenobarbitone	Blood 7.5 ml (B) Record dosage and sample date/time	Contact laboratory
Phenytoin	Blood 7.5 ml (B)	5 - 20 mg/L
Phosphate	Blood 7.5 mL (B)	0.8 - 1.5 mmol/L
Phosphate (urine)	24 hr urine	15.0 - 50.0 mmol/d
Phytanic Acid (see VLCFA)	Blood 3.4 ml (R) – fasting Send to lab immediately.	Descriptive report
Placental Growth Factor (PLGF)	Blood 7.5 mL (B)	
Pompe Disease (α-Glucosidase)	Blood 3.4 ml (R) - Send to laboratory before 12 noon Mon – Weds only.	
Porphyrins	Blood 3.4 ml (R) - protect from light	Descriptive report
Porphyrins (faeces)	Random faeces - protect from light	Descriptive report
Porphyrins (urine)	Random urine or 24 hr collection - Protect from light	Descriptive report
Potassium	Blood 7.5 ml (B)	3.5 - 5.3 mmol/L
Potassium (Plasma)	Blood 7.5 ml (O)	
Potassium (urine)	Random urine 24 hr urine	20-60 mmol/L 25 -125 mmol/d
Pregabalin	Blood 7.5 ml (W) Record dosage and sample date/time	2 - 8mg/L
Primidone	Blood 7.5 ml (W) Record dosage and sample date/time	5- 10mg/L
Procalcitonin	Blood 7.5 ml (B)	<0.5 ng/mL
Procollagen Extension Peptide (P1NP)	Blood 7.5 ml (B)	
Procollagen III N-peptide (P3NP)	Blood 7.5 ml (W)	Adults: 1.7-4.2 µg/L
Progesterone	Blood 7.5 ml (B) - state date of last	Follicular: 0.6 – 4.7 nmol/L

	menstrual period if known	Ovulation: 2.4 – 9.4 nmol/L Luteal: 5.3 - 86 nmol/L Post menopause: 0.3 - 2.5 nmol/L
Pro-insulin	Blood 7.5 ml (B) and 4.9 ml (Y) for glucose. Send to lab immediately	< 10 pmol/L in hypoglycaemia
Prolactin	Blood 7.5 ml (B)	Females: 102 - 496 mU/L Males: 86 - 324 mU/L
Prostate Specific Antigen (PSA)	Blood 7.5 ml (B)	Males <49yrs = <2.0 ng/mL <59yrs = <3.9 ng/mL <69yrs = <5.4 ng/mL <110rs =<6.2 ng/mL
Protein (Total)	Blood 7.5 ml (B)	60 - 80 g/L
Protein (urine)	Random urine 24 hr urine	0 - 0.15 g/L 0 - 0.15 g/d
Protein (CSF)	CSF 2.7 mL (Y)	0.15 - 0.40 g/L
Protein Electrophoresis (PE)	Blood 7.5 mL(B) or Random urine	Descriptive report
Purines and Pyridimines	Random urine and 3.4 mL (R)	
Quetiapine	Blood 3.4 ml (R) - pre dose	Contact laboratory
Rapamycin (Sirolimus)	Blood 3.4 ml (R) - 24h pre-dose	
RAST (specific IgE)	Blood 7.5 mL (B)	
Renin	Blood **2** x 3.4 ml (R) Patient must rest 15mins. Send to laboratory immediately	
Rifampicin	Blood 7.5 mL (B)	8 -24 µg/L
Rheumatoid Factor (RF)	Blood 7.5 ml (B)	
Risperidone	Blood 3.4 mL (R) Record dosage and sample date/time	Contact laboratory
S100B Protein	Blood 7.5 ml (B). Send to laboratory immediately	< 0.2µg/L
Salicylate	Blood 7.5 ml (B)	<10 mg/L
Selenium	Blood 7.5ml (O) LH Trace Metal Tube	See report
Sensitive IgA	Blood 7.5 ml (B)	
Sensitive PSA	Blood 7.5 ml (B)	
Serotonin /5-hydroxytryptamine (5-HT)	Blood 3.4 ml (R). Send to laboratory immediately	
SHBG (Sex Hormone Binding Globulin)	Blood 7.5 ml (B)	Females: 20-49yrs 32.4-128 nmol/L Females: >50yrs 27.1- 128 nmol/L Males: 20-49yrs 18.3-54.1 nmol/L Males: >50yrs 20.6-76.7 nmol/L
Soluble fms-like tyrosine kinase-1 (SFLT)	Blood 7.5 mL (B)	
SFLT / PLGF ratio (Pre-eclampsia risk)	Blood 7.5 mL (B)	
Sirolimus (Rapamycin)	Blood 3.4 ml (R) - 24h pre-dose	
Sodium	Blood 7.5 mL (B)	133 - 146 mmol/L
Sodium (urine)	Random urine 24 hr urine	50 - 125 mmol/L 40 - 220 mmol/d
Steroid Profile (urine)	24 hr plain urine collection	Descriptive report

Sulphonylurea	Blood 7.5 ml (B) Random urine also acceptable	Contact laboratory
Tacrolimus (FK506)	Blood 3.4 ml (R) >12 hrs post dose Record dosage and sample date/time	Therapeutic ranges differ according to clinical circumstances. Suggested therapeutic range 1-12 µg/L.
Testosterone	Blood 7.5 ml (B)	Females: 20-49yrs: 0.29 - 1.67 nmol/L Females: >50yrs: 0.10 - 1.42 nmol/L Males: 20-49yrs: 8.64 - 29.0 nmol/L Males: > 50yrs: 6.68 - 25.7 nmol/L
Theophylline	Blood 7.5 ml (W) – collect prior to dose	10 – 20 mg/L.
Thyroglobulin	Blood 7.5 ml (B)	Contact laboratory
Thyroid peroxidase Abs (aTPO)	Blood 7.5 ml (B)	<34 mIU/L = Negative 34 mIU/L = Equivocal >34 mIU/L = Positive
Thyroid Stimulating Hormone (TSH)	Blood 7.5 ml (B)	0.27 – 4.20 mIU/L
Thyroid Stimulating Immunoglobulin (TSI)	Blood 7.5 mL (B)	Contact laboratory
TSH Receptor Antibody (TRAB)	Blood 7.5 ml (B)	Healthy ≤1.22 IU/L Thyroid disease ≤1.58 IU/L
Topiramate	Blood 7.5 ml (W) Record dosage and sample date/time	5 - 20mg/L
Thiopurine Methyltransferase (TPMT)	Blood 3.4 ml (R)	
Transferrin	Blood 7.5 ml (B)	2.0 – 3.6 g/L
Transferrin glyco/isoforms	Blood 7.5 ml (B)	Descriptive report
Triglyceride	Blood 7.5 ml (B)	0.3 – 1.8 mmol/L
Triple test (Down's/Maternal) screening	Blood 7.5 ml (W)	
Troponin T (TNT)	Blood 7.5 ml (B)	<14 ng/L
Tryptase	Blood 7.5 ml (B) - take within 3h of event and a baseline sample also taken 24h after the event	Contact laboratory
Trimethylamine	Random or 24hr collection with HCL	2.5 - 10.9 µmol/mmol creatinine
Urea	Blood 7.5 ml (B)	2.5 - 7.8 mmol/L
Urea (urine)	Random urine 24 hr urine	125 - 500 mmol/L 428 - 714 mmol/d
Uric Acid	Blood 7.5 ml (B)	Females: 140 - 360 µmol/L Males: 200 - 430 µmol/L
Uric Acid (urine)	24 hr urine	1.5 – 4.5 mmol/d
Valproate	Blood 7.5 ml (B) – collect any time	50 - 100 mg/L
Vancomycin	Blood 7.5 ml (B) - record time of collection	Therapeutic vancomycin levels should be between 10 and 15 mg/L
Vasoactive Intestinal Peptide (VIP) (see Gut Hormones)	Blood 2 x 3.4 ml (R) - Send to laboratory immediately on ice.	<30 pmol/L
Very Long Chain Fatty Acids	Blood 3.4 ml (R) - fasting.	Descriptive report.
Vigabatrin	Blood 7.5 ml (W)	2 - 36 mg/L
Vitamin A	Blood 7.5 ml (B) – protect from light	Age/sex related. Contact laboratory

Vitamin B1 (thiamine)	Blood 3.4 ml (R) - protect from light	
Vitamin B2 (riboflavin)	Blood 3.4 ml (R) - protect from light	
Vitamin B6 (pyridoxine)	Blood 3.4 ml (R) - protect from light.	
Vitamin B12	Blood 7.5 ml (B)	197 - 771 pg/mL
Vitamin D (1,25 Dihydroxy)	Blood 7.5 ml (B)	48 - 120 pmol/L
Vitamin D (25 Hydroxy Cholecalciferol)	Blood 7.5 ml (B)	<25 nmol/L deficient 25-50 nmol/L may be inadequate in some >50 nmol/L sufficient for most people
Vitamin E	Blood 7.5 ml (B) – protect from light	11.5 – 46.4 µmol/L
White cell (lysosomal) enzymes	Blood 7.5 ml (O) - Mon or Wed only	Descriptive report
Xanthine	Blood 9 mL (O) + 3.4 mL (R) or 24hr urine	Descriptive report
CSF Xanthochromia	CSF (plain) , Blood 2.7 mL (Y) and Blood 7.5 mL (B)	Protect CSF sample from light Descriptive report
Zinc	Blood 7.5ml (O) LH Trace Metal Tube	Age/sex related. Contact laboratory

13. PRESERVATIVES FOR URINE COLLECTIONS

TESTS	COLLECTION	PRESERVATIVE	NOTES
5HIAA	**24hr**	**PLAIN or ACID**	
Albumin / Creatinine ratio (Microalbumin)	**Random**	**PLAIN**	Acidified collection NOT acceptable
Amino Acids	**Random (store frozen)**	**PLAIN**	Freeze until referral
Calcium	**Random or 24hr**	**PLAIN or ACID**	Suitable for preservation on receipt (pH must be <3)
Copper	**24hr**	**ACID washed**	
Cortisol (UFC)	**24hr**	**PLAIN**	Acidified collections also accepted
Chloride	**Random or 24hr**	**PLAIN**	
Citrate	**24hr**	**PLAIN**	Unsuitable for preservation on receipt
Creatinine	**Random or 24hr**	**PLAIN**	Acidified collection acceptable
Cystine	**24hr (random if <16 yrs)**	**PLAIN**	
Drug screen / Toxicology	**Random**	**PLAIN**	Do not open the original container. Freeze until referred.
Electrolytes (Sodium / Potassium)	**Random or 24hr**	**PLAIN**	
Electrophoresis (Bence Jones protein)	**Random or 24hr**	**PLAIN**	Acidified collection NOT acceptable
Glycosaminoglycans	Random	Nil	Freeze until referred
Mercury	**Random**	**PLAIN**	Acidified collection NOT acceptable
Metanephrines / catecholamines	**24hr**	**PLAIN or ACID**	
Organic Acids	**Random (store frozen)**	**PLAIN**	
Osmolality	**Random or 24hr**	**PLAIN**	
Oxalate	**24hr**	**ACID preferred or PLAIN**	
Phosphate	**Random or 24hr**	**PLAIN or ACID ***	**Suitable for preservation on receipt (pH must be <3)**
Porphyrins / Porphobilinogen	**Random (protect from light)**	**PLAIN**	**Should be accompanied by an EDTA sample and a faeces sample and protect all samples from light**
Protein	**Random or 24hr**	**PLAIN**	Acidified collection NOT acceptable
Protein / Creatinine ratio (PCR)	**Random**	**PLAIN**	Acidified collection NOT acceptable
Reducing substances	**Random**	**PLAIN**	
Steroid profile	**24hr (random if <16yrs)**	**PLAIN**	Acidified collection NOT acceptable
Stone screen	**24hr**	**PLAIN**	
Sulphonylurea	**Random**	**PLAIN**	Acidified collection NOT acceptable
Urate	**Random or 24hr**	**PLAIN**	Acidified collection NOT acceptable
Urea	**Random or 24hr**	**PLAIN**	Acidified collection NOT acceptable
VMA / Creatinine ratio	**Random (store frozen)**	**PLAIN**	

14. DYNAMIC FUNCTION TEST PROTOCOLS

Multiple Blood Sampling Technique

Many dynamic function tests require several blood samples, and to spare the patient repeated venepuncture an indwelling cannula is placed in a suitable forearm vein, from which multiple samples may be obtained without discomfort. Which cannula is used is a matter of personal preference: the "Venflon" type tends to be more secure but probably more traumatic, while the "Butterfly" is perhaps less reliable for prolonged sampling, but is no more painful than a simple venepuncture. After introduction of the cannula a small volume (0.5 mL) of heparinised saline ("Hepsal") is injected to prevent clotting. At each sampling 2 mL of blood is withdrawn and discarded (the dead space), then the appropriate volume for the test obtained. Again the cannula is flushed through with a small volume of heparinised saline.

14.1. ORAL GLUCOSE TOLERANCE TEST

Procedure

The patient fasts from midnight. At time 0 a cannula is placed in a suitable forearm vein, 75 g glucose is given orally, either in orange juice or as 113 mL "Polycal". The amount of glucose given is adjusted for children to 1.75 g per kilogram body weight up to the maximum of 75 g.

The formal OGTT involves sampling at 30 minute intervals for 2 hours, but if the investigation is being performed to establish/refute a diagnosis of diabetes mellitus, a 0 and a 120 minute sample are sufficient. The samples are taken into fluoride tubes (Sarstedt yellow cap).

Interpretation

Glucose in venous plasma, mmol/L:

DIAGNOSIS	FASTING	2 HR
Normal	<6.1	<7.8
Impaired GT	<7.0	7.8 to <11.1
Diabetic	≥7.0	≥11.1

14.2. PROLONGED (5 HR) GLUCOSE TOLERANCE TEST

In active acromegaly growth hormone levels are not suppressed by a glucose load. The "growth hormone suppression test" is simply the 75 g OGTT with samples taken for growth hormone (Sarstedt brown capped tube) at 30 minute intervals. In normal subjects GH levels fall to <2 mU/L, while in acromegaly there is no suppression or even a paradoxical rise.

Measurement of IGF-1 (a single random blood sample, brown capped tube), may give the same information as the OGTT, and is obviously more convenient.

RARELY OF USE IN ANY CLINICAL SITUATION and probably responsible for misdiagnosis of "reactive hypoglycaemia" in many patients. Samples are taken as for the 75 g OGTT and at 3, 4, and 5 hours. In many normal individuals the blood glucose level falls to 2.5 mmol/L, without symptoms. The test is NOT recommended, and is inappropriate for patients in whom a diagnosis of insulinoma is being considered. In the latter, fasting with blood sampling for glucose, insulin and C-peptide if and when symptoms occur is the preferred investigation.

Procedure

The following is a summary of the procedure to be followed. Full details are provided within the test kit used. These details must be strictly adhered to if a meaningful interpretation of the test result is to be made.

The patient eats and drinks normally on the evening prior to the test, but no vitamin supplements may be taken until the test is complete.

DAY ONE

06.30 Pass urine and discard. Drink 500 mL of liquid.

07.00 Eat a test meal of 50 g bread with 220 g of butter. Swallow the blue capsules during the meal and drink a cup of liquid.

FROM THIS POINT, ALL URINE MUST BE COLLECTED INTO A LABELLED BOTTLE. NO PRESERVATIVE REQUIRED

10.00 Drink on litre of liquid between 1000 am and noon.

12.00 Eat and drink as required.

17.00 The bladder is emptied as completely as possible and the urine is added to the collection. The procedure for day one is now complete.

DAY TWO

The procedure is followed exactly as for day ONE excepting that the red capsules are taken with the meal. Both urines are sent to the laboratory.

Interpretation

The results are expressed as the **T/K ratio.**

- Ratio less than 20 indicates low pancreatic exocrine function.
- Ratio 20-30 is equivocal.
- Ratio greater than 30 indicates normal pancreatic exocrine function.

14.3. INSULIN TOLERANCE TEST

This test is potentially dangerous, and fatalities have been reported. It should only be performed under constant medical supervision. Contraindications include ischaemic heart disease, epilepsy, and a random serum cortisol concentration of <100 nmol/L. The stress of hypoglycaemia is used to stimulate secretion of ACTH and growth hormone. Note that in many cases ACTH/adrenal function may be assessed using the short Synacthen test, thus avoiding the use of insulin.
Intravenous glucose 50% and hydrocortisone 200 mg for IV injection must be readily available.

Procedure

After fasting from midnight, at 08.00 - 09.00 hrs the patient is weighed and an indwelling cannula placed in a forearm vein, kept patent with Hepsal. After 30 minutes (time 0) Actrapid insulin is given as an IV bolus. The standard dose is calculated as 0.15 units insulin per kilogram body weight. If insulin resistance is suspected (Cushing's syndrome, acromegaly) the dose is 0.3 units per kg; if there is suspicion of adrenal hypofunction the dose is reduced to 0.1 units per kg.

Blood for glucose, cortisol and growth hormone is taken at 0, 30, 60, 90 and 120 minutes. Some workers prefer to check the glucose at 15 minutes. Glucose is collected into the yellow topped

fluoride tube; while the brown topped 7.5 mL Sarstedt tube is sufficient for growth hormone and cortisol. Bedside monitoring of the blood glucose is very useful.

Signs and symptoms of hypoglycaemia occur ca. 20 – 30 minutes post injection (sweating, tachycardia, neuroglycopaenia). If these do not occur and the blood glucose has not fallen, a second equivalent dose of insulin is given.
If symptoms are severe and/or prolonged, hypoglycaemia is reversed with intravenous glucose 25 - 50 mL 50%. This does not invalidate the response of growth hormone and cortisol, and sampling should continue. At the end of the test the cannula is removed and the patient is given a meal, and observed for at least one hour before leaving the ward.

Interpretation

Blood glucose should fall below 2.2 mmol/L accompanied by symptoms of hypoglycaemia.
Cortisol should rise by 200 nmol/L to greater than 550 nmol/L.
Growth hormone should rise to >20 mU/L.
In Cushing's syndrome, the cortisol does not increase, and this has been used to differentiate these cases from depressed patients with raised cortisol levels.

14.4. THYROTROPHIN RELEASING HORMONE TEST

This is performed less frequently nowadays following the introduction of highly sensitive TSH assays. However, the test still has a place in certain situations, to demonstrate the capacity of the pituitary to respond. No specific patient preparation is required. TRH may be combined with the ITT/LHRH tests, but recent opinion has cast doubt on the usefulness of this pituitary test (See Pavord et al., Clinical Endocrinology (1992) **36**:135).

Procedure

A cannula is placed in a forearm vein, and at time 0 a sample removed for fT4 and TSH assay into a brown capped Sarstedt tube. 200 mg TRH is given as in IV injection SLOWLY (over at least 1 minute, preferably more). Rapid bolus administration is associated with unpleasant symptoms (nausea, desire to micturate, syncope). Further blood samples for TSH are taken at 20 and 60 minutes post TRH.

Interpretation

Normally TSH rises by >2 mU/L to >5 mU/L, the 20 minute level being higher than the 60 minute. Some workers simply sample at 0 and 20 minutes. A reduced or flat response is seen in many situations, typically thyrotoxicosis but also acromegaly, hypopituitarism, patients taking thyroxine, multinodular goitres, the euthyroid sick syndrome and other conditions. The chief value of the test is that a normal response excludes hyperthyroidism, but similar information is given by a single normal TSH level using the sensitive assays. Often in hypothalamic diseases the 60 minute level is greater than the 20 minute, but this is by no means specific.

14.5. GONADOTROPHIN RELEASING HORMONE TEST

As with TRH, this test is less useful than previously thought, but is still performed in certain patients to assess gonadotrophin reserve. It may be combined with the ITT and TRH tests.

Procedure

A cannula is placed in a forearm vein and at time 0 a blood sample removed into a brown capped Sarstedt tube for LH and FSH assay. 100 mg of gonadotrophin releasing hormone (GnRH, LH/FSH-RH) is injected as a bolus and further samples for LH and FSH taken at 20 and 60 minutes.

Interpretation

Normally LH and FSH rise at 20 minutes, but there is little agreement on the precise definition of normality. In constitutional delay of puberty the LH peak exceeds that of FSH. In polycystic ovarian syndrome the LH peak is greatly in excess of the FSH peak.
In suspected hypogonadism due to pituitary disease the test gives little more information than basal gonadotrophin plus testosterone/oestradiol levels.

Adrenal - The hypothalamic/pituitary/adrenal axis may be assessed by the ITT, and this test remains the "gold standard". However, adequate information regarding ACTH/adrenal reserve may be obtained using the less stressful Synacthen tests. In cases of virilisation/hirsutism, measurements of testosterone, SHBG, LH/FSH, 17OH-progesterone and DHEAS may be required.

14.6. WATER DEPRIVATION TEST

This is used to assess vasopressin reserve. The test is potentially dangerous in diabetes insipidus, and close supervision is required throughout. Patients with hypopituitarism should be adequately treated with glucocorticoids and thyroxine. Ideally the test is performed in a side room where no water is available for surreptitious ingestion.
Inform the laboratory that the test will be performed well in advance of the date.

Procedure

Fluids ad libitum are allowed until the morning of the test. A light breakfast is given at 0800 hours (no tea, coffee), and smoking is forbidden. The patient is weighed accurately and a basal blood sample for serum osmolality is taken into a brown capped tube. A specimen of urine is also required for osmolality, taken into a container with NO preservative (boric acid invalidates the osmolality measurements). If the basal plasma osmolality exceeds 300 mOsm/kg in the presence of a dilute urine the diagnosis of diabetes insipidus is made and ADH is given (vide infra).
No fluids are allowed, and samples for plasma and urine osmolality are obtained at hourly intervals. The urine volume is measured and charted, as is the patient's weight. If concentration of the urine has not occurred after 8 hours, 20 microgram Desmospray is given intranasally, and further urine samples collected hourly thereafter for 4 hours. Fluids are allowed after the Desmospray has been administered.
The test should be terminated if the serum osmolality rises above 300 mOsm/kg, and/or the patient loses > 3% of body weight. Desmopressin is given as above, with free fluids.

Interpretation

May be difficult, particularly in patients with primary polydipsia. Normally the serum osmolality remains within the reference range (280-295 mOsm/kg), and the urine: plasma osmolality ratio rises to >2.0, at which point the test is terminated. Partial defects of ADH secretion may give equivocal results.
Suspicion that the patient is taking fluids surreptitiously is passage of large quantities of dilute urine without weight loss. An accurate balance capable of reading to 50 g is essential.

14.7. PENTAGASTRIN ACID OUTPUT STUDIES

This test is occasionally employed to exclude a diagnosis of achlorhydria in patients with raised gastrin levels and peptic ulceration.

Procedure

The patient fasts for twelve hours without food or drink.
A nasogastric tube is passed into the stomach, preferably confirmed radiologically. The stomach contents are emptied with a hand syringe and labelled fasting contents.
The next two fifteen minute specimens are collected to give basal secretion.
Pentagastrin 6 micrograms per kilogram body weight is given subcutaneously.
Subsequently four accurately timed fifteen minute specimens are collected.
It is helpful to blow air down the nasogastric tube every five minutes or so to prevent blockage. The samples then go straight to the laboratory.

Pentagastrin Stimulation (Calcitonin)

This test is performed to screen for medullary carcinoma of the thyroid (MCT). It should NOT be performed in pregnancy.

Procedure

After overnight fasting, the patient is weighed and a cannula placed in a forearm vein. At time 0 a blood sample for calcitonin is taken into a heparinised tube (Sarstedt 7.5 mL orange cap) and pentagastrin ("Peptavlon") 0.5 micrograms/kg body weight injected intravenously over 10 seconds. Further samples for calcitonin assay are obtained at 1 and 5 minutes post injection. The samples are placed on ice and taken to the laboratory immediately for separation.
Side effects include sensations of warmth and/or burning, flushing, nausea and abdominal discomfort, but are transient and disappear after a few minutes.

Interpretation

In normal subjects peak calcitonin levels are <0.21 mg/L in males, <0.11 mg/L for females. Raised levels are highly suggestive of C-cell hyperplasia/medullary carcinoma of the thyroid.
In patients with a strong family history of MCT the test should be performed at regular intervals, yearly from the age of 5 years to teens, 2 yearly until late twenties, and 3-5 yearly until age 40.
Recent developments suggest that a specific DNA test for the mutation causing MCT may be more sensitive than the pentagastrin stimulation test, particularly in cases of multiple endocrine neoplasia type II. 10 mL blood in EDTA (Sarstedt red cap) are required with an appropriate letter giving all relevant details and sent first class/van delivery to:

Molecular Genetics
East Anglian Regional Genetics Laboratory
Addenbrookes Hospital
Hills Road
CAMBRIDGE
CB2 2QQ
(Arranged through the laboratory).

14.8. HUMAN CHORIONIC GONADOTROPHIN (HCG) TEST

This test assesses the presence of functional testicular tissue.

Procedure

Blood for testosterone assay (Sarstedt 7.5 mL brown capped tube) is taken at time 0 and 2000 units HCG given by intramuscular injection on day 0 and day 2. Further samples for testosterone are obtained on days 2 and 4.

Interpretation

In normal subjects the serum testosterone concentration rises above the reference interval. Failure to rise indicates the absence of functional testicular tissue. If the testes are not in the scrotum, but a positive response to HCG is seen, the testes may be intra-abdominal.
In secondary hypogonadism due to pituitary disease, a low basal testosterone level will increase threefold after HCG.

14.9. CLOMIPHENE TEST

This test is sometimes helpful in distinguishing gonadotrophin deficiency from weight related hypogonadism and constitutional delay of puberty.

Procedure

Clomiphene 3 mg/kg body weight is given in three divided doses daily for 7 days (maximum dose 200 mg daily). Blood samples for serum LH and FSH (7.5 mL Sarstedt brown capped tube) are obtained on day 0, 4, 7 and 10.

Interpretation

In normal subjects both LH and FSH rise above the reference interval, or the basal level is doubled. Some patients with anorexia nervosa show no response until weight has been gained. Pre-pubertal children do not respond to clomiphene.

14.10. URINE ACIDIFICATION TEST

Used to establish/refute a diagnosis of renal tubular acidosis. The laboratory should be informed well in advance of the test.

Procedure

Patient is weighed and may have normal meals thereafter. At 0800 hours the bladder is emptied and hourly urine collections are begun and put into plain bottles with no preservative.
At 1000 hours ammonium chloride 100 mg/kg body weight is given orally over a period of 1 hour. This is most conveniently taken in the form of capsules supplied by Pharmacy to avoid gastric irritation and nausea. Blood for electrolytes and bicarbonate (specified) is taken at 1000, 1400 and 1800 hours (Sarstedt brown capped tube) and hourly urines for pH measurement throughout the test.

Interpretation

In normal subjects the urine pH (determined by a pH meter, NOT using the sticks) should fall to below 5.3 at some point during the test, which may then be terminated. The test should not be performed if the basal serum bicarbonate level is less than 19 mmol/L. A fall in plasma bicarbonate during the test confirms that the NH_4Cl has been ingested and absorbed.

15. POINT OF CARE (POCT) SERVICES

Colchester Point of Care Coordinator: Gaynor Diaz

Ext 2149 (04206 742149)

POCT.enquiries@esneft.nhs.uk

Blood glucose meters: For faulty Nova Statstrip meters please call POCT on ext 2149, or bring device to the POCT office in Blood sciences for troubleshooting.

POCT equipment training: Training is available for blood gas analysers, Nova meters, urine meters, pregnancy test kits, Foetal fibronectin, PROM tests, Hemocue, Hemochron, IDNOW, DCA Vantage HbA1c analysers and urinary drugs of abuse screening kits. Please call the POCT office for details

E-Learning: Online competency assessments are available for some of the POCT devices in use. Please call the POCT coordinator for details.

External Quality Assurance schemes (EQA): We are working towards accreditation under ISO 15189 and ISO 22870 which require all POCT medical devices be enrolled on EQA schemes. Samples are sent regularly and participation by all staff involved in testing patient samples is mandatory. For details please contact the POCT coordinator.

Blood gas analysers: Analysers are available for use by trained staff only. For training and barcodes please contact the POCT coordinator.

Blood gas samples should be:

- collected into electrolyte balanced heparinised syringes
- MUST be free from air bubbles, capped and mixed for at least 1 minute before analysis.
- minimum of 1ml of blood is required for accurate results.
- If not analysed immediately should be mixed for longer.

New equipment: Any department considering introducing new POCT equipment must seek the advice of the POCT committee. For details please contact the POCT coordinator.

16. INFORMATION FOR PATIENTS

- Collection of a random urine sample - tba
- Collection of a 24 hour urine sample - tba