South Eastern Health and Social Care Trust

# ULSTER HOSPITAL LABORATORY USER MANUAL 2026

## Edition 5

**(Revised 02/11/2026)**

**LOOKING FOR SPECIFIC INFORMATION?**

**Type the "test name" or a "keyword" in the text search box on the tool bar above and press enter ( ↵ )**

**(or use 'Ctrl+F' keyboard shortcut if search box not displayed)**



*Electronic only document - if printed, this document is uncontrolled*

# PREFACE

This user manual is a guide to the use of Laboratory services available at the Ulster Hospital, which is part of the South Eastern Health and Social Care Trust. It is hoped that it will provide the Laboratory user with a quick and easy reference to the services available in the Trust Laboratory. Information is provided on types of specimens required, interpretation of results and common interferences in test results. If you wish further advice, please contact the appropriate Laboratory department.

The Laboratory endeavours to produce high quality results in a timely manner. We welcome comments from our users about the services currently available, which may lead to future improvements of the service.

Dr Kathryn Ryan

Laboratory Clinical Director

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# GENERAL INFORMATION

## LABORATORY CONTACT DETAILS

**ADDRESS:** South Eastern Health and Social Care Trust
Clinical Pathology Laboratory
Critical Care Complex
Ulster Hospital
Belfast
BT16 1RH

**LABORATORY CLINICAL DIRECTOR:** Dr Kathryn Ryan Tel: 028 9041 1580
kathryn.ryan@setrust.hscni.net

**LABORATORY SERVICES MANAGER:** Sinead Carty Tel: 028 9041 1572
sinead.carty@setrust.hscni.net

**POINT OF CARE MANAGER:** Dr Derek McKillop Tel: 028 9041 1706
derek.mckillop@setrust.hscni.net

**LABORATORY QUALITY MANAGER:** Darren Crawford Tel: 028 9041 1565
darren.crawford@setrust.hscni.net

**USEFUL ELECTRONIC LINKS:**

iConnect: https://hscni.sharepoint.com/sites/SEHSCT-Iconnect

SET website: https://setrust.hscni.net/service/laboratory-services/

BHSCT website: https://belfasttrust.hscni.net/service/laboratory-services/

## LABORATORY HOURS OF SERVICE

| | | |
|---|---|---|
| **Normal Laboratory Hours** | Monday – Friday | 9am – 5pm |
| **Service on Public Holidays and Weekends** | Saturday, Sunday & Public Holidays | 9am – 1pm |

There is only a restricted service provided on Public Holidays and weekends. Requests should be confined to essential investigations and specimens should reach the Laboratory by 10.30am. An emergency out-of-hours service operates outside of these hours throughout the year.

## LOCATION OF LABORATORY

The Laboratory is located on the 4th floor of the Critical Care Complex at the Ulster Hospital. The Critical Care Complex can be accessed through the main entrance to the Critical Care Complex, opposite the multi-story car park, or from the main entrance at the Ulster Hospital Ward block, at the front car park. If entering from the main entrance at the Ulster Hospital Ward block, follow the signs for the Critical Care Complex along the main corridor. Once in the foyer of the Critical Care Complex, you can either take the lift or the stairs to the Laboratory, which is located on the 4th floor.

## TEST REQUESTING

### Service Agreement

Each request accepted by the Ulster Hospital Laboratories for examination(s) shall be deemed to be an agreement by the user for the South Eastern Health & Social Care Trust (SEHSCT) Laboratories, or their selected referral Laboratories, to carry out the Laboratory services requested. It also implies an acceptance of the conditions of preparation and transport as outlined in this user manual.

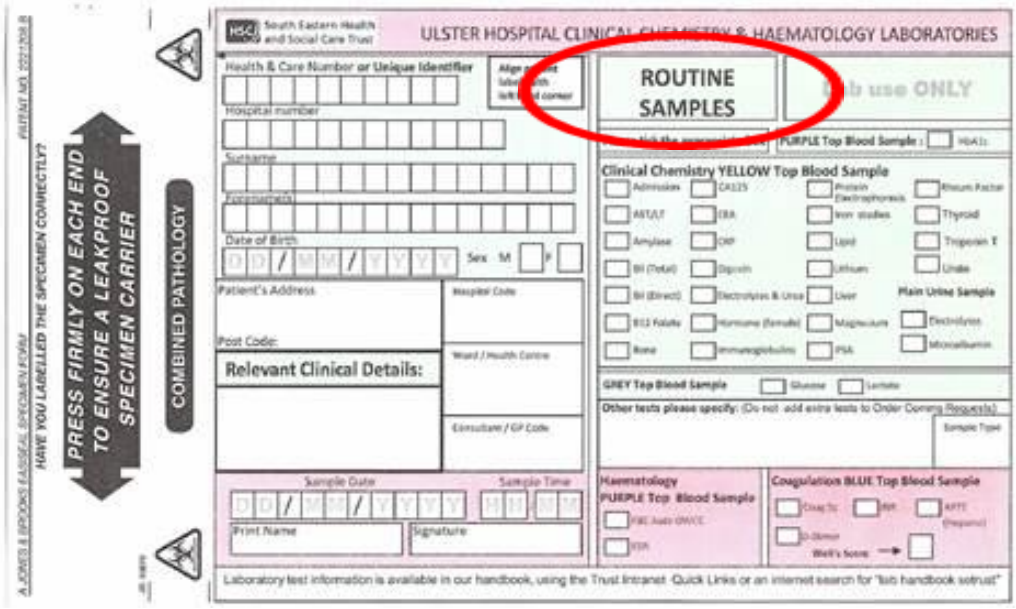
### Request Forms

***See Appendix J for full instructions to Ulster, Bangor and Ards Hospital Users for sending specimens to the Laboratory post Encompass go-live.***

Tests must be requested using the Encompass electronic ordering system or the appropriate SEHSCT request form:

- Blood Transfusion request form
- Blood Transfusion Kleihauer request form
- Clinical Biochemistry urgent request form
- External Referral request form
  ***(if requests are for BHSCT Cytology, Immunology, Genetics, Histopathology, or Virology please continue to use the BHSCT request forms for these areas)***
- Haematology urgent request form
- Joint Routine Clinical Biochemistry / Haematology request form
- Microbiology request form
- Semen Analysis: Post Vasectomy request form

Users must ensure that they only use the Clinical Biochemistry and Haematology Urgent specimen bags and/or request forms for genuinely urgent requests, i.e. requests where results are required by the clinician within 90 minutes of receipt by the Laboratory. The clear pathology specimen bag and/or joint Biochemistry-Haematology request form (below) should be used for all routine, non-urgent, requests. These requests will be processed within 4 hours of receipt; however the majority of these requests are processed within 2 hours.

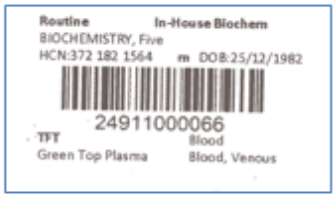



**The use of the urgent specimen bags/request forms for non-urgent requests will lead to delays in specimen processing of genuinely urgent specimens & will be a risk to patient safety.**

When requesting tests manually use the tick boxes on the request form. If the tick boxes do not include the test you require please enter the name of the test in the 'Other Tests' area of the request form.

When ordering via Encompass, **inpatient sample collection is a 4-step process which must be completed beside the patient, by one member of staff as one uninterrupted process:**

1. **Identify Patient:** Ask the patient their name & DOB then scan patient ID Band. Confirm details are correct including HCN/MRN. This ensures positive patient ID (PPID).
2. **Print and check all sample barcode labels-** see example below
   Before printing ensure labels are aligned correctly in the printer and all tests being collected have been selected.
   Once printed check all information on the label(s) is correct and belongs to the patient.
   Please note for transfusion samples a label is also printed & must be applied to the request form.




3. **Obtain sample(s) & attach sample label(s) to the correct tubes.**
   - Tube type and urgency will be printed on the label e.g. green top, purple top, routine, urgent etc.
   - Only attach one barcode label per tube
   - Make sure label is straight and correctly aligned.
4. **Complete collection process in encompass**
   Click 'Collect', re-scan patient ID band & each labelled sample tube.
   - Only labels printed from encompass at time of sampling and beside the patient are acceptable.
   - Labels printed in advance or away from the patient **must not be used**.
   - Sample tubes must never be pre-labelled.

**Failure to complete all the steps above means the laboratory cannot process the sample.**

## Request Form and Specimen – Required Details

As per the Northern Ireland Pathology Network Regional Sample Request Acceptance & Rejection Policy for Pathology Services there is a defined minimum acceptance criteria (MAC) in place for the receipt and identification of Laboratory samples, allowing the Laboratories to ensure that the right result on the right patient gets back to the appropriate clinical teams in a timely fashion.

The tables below and overleaf list the MAC for request forms (including electronic orders) and samples since encompass go-live. All required points must be present and legible on the request form/electronic order and sample tube/container:

| REQUEST FORM / ELECTRONIC ORDER MAC | Blood Transfusion | Biochemistry & Haematology | Microbiology |
|---|---|---|---|
| H&C Number* | ✓ | ✓ | ✓ |
| Official First Name | ✓ | ✓ | ✓ |
| Surname | ✓ | ✓ | ✓ |
| Sex | ✓ | ✓ | ✓ |
| Date of Birth (dd/mm/yyyy) | ✓ | ✓ | ✓ |

| REQUEST FORM / ELECTRONIC ORDER MAC | Blood Transfusion | Biochemistry & Haematology | Microbiology |
|---|---|---|---|
| Date & Time of Sample Collection | ✓ | ✓ | ✓ |
| Requestor Name/Code | ✓ | ✓ | ✓ |
| Source (Ward/Clinic/GP) | ✓ | ✓ | ✓ |
| Investigation (test) Required | ✓ | ✓ | ✓ |
| Signature/Name of Staff Member Taking the Sample | ✓ | | |
| Anatomical Site and Specimen type | | | ✓ |

| SAMPLE MAC | Blood Transfusion | Biochemistry & Haematology | Microbiology |
|---|---|---|---|
| H&C Number* | ✓ | ✓ | ✓ |
| Official First Name | ✓ | ✓ | ✓ |
| Surname | ✓ | ✓ | ✓ |
| Sex | ✓ | | |
| Date of Birth | ✓ | ✓ | ✓ |

**The H&C Number must be used unless the patient is not registered with a GP in NI / is registered but does not yet have their H&C number (in which case, it must clearly state "No H&C number available" on the request form) or in an emergency situation (in which case, use the local hospital emergency numbering system)*.

*On the rare occasions that there is no unique identification number available this must have been stated on the form. We will attempt to process the specimen in these instances with a comment attached stating that there was no unique identification number given and the results should be interpreted with caution.*

**FOR REQUESTS TO BE ACCEPTED THE INFORMATION ON BOTH THE REQUEST FORM / ELECTRONIC ORDER AND ANY SPECIMENS MUST MATCH.**

The full Specimen Acceptance Procedure [SPEC RECEPT-3] is available from the Laboratory.

For manual orders, patient labels should be used if available. The label must be placed within the space provided on the form and details of the source (ward or health centre) and consultant/GP should be written on by hand if not included on the patient label. ***Addressograph labels may be used on Blood Transfusion request forms, however specimen tubes must be hand written. Both the request form and specimen tube must be signed for Blood Transfusion requests.***

### Out-of-Hours Urgent Requests

Only certain tests are available as an urgent request, please see each department's individual section in this user manual for the list of tests available as an urgent request.

In **Clinical Biochemistry**, electronic urgent requests are sent in a yellow Clinical Biochemistry specimen bag, whereas manual orders are sent on a yellow Clinical Biochemistry urgent request form. For clinical emergency cases, where an exceptional response is required, the requestor must call 07872048346 or 63634 to highlight the request with the department.

Urgent requests for **Haematology** and **Microbiology** must always be arranged with the on-call Haematology or Microbiology BMS. For Haematology and Blood Transfusion requests the requestor must call 52262 / 07712853930 and arrange the requests with the on-call Haematology and Blood

Transfusion BMS. For **Microbiology**, contact the department via the Ulster Hospital switchboard, 028 9048 4511.

***If you experience any difficulty in directly contacting one of the on-call BMS', please contact the Ulster Hospital switchboard, 028 9048 4511.***

The Consultant Chemical Pathologists, Haematologists, and Microbiologists each carry a bleep and provide a 24-hour consultation service. Out of hours contact may be made via the Ulster Hospital switchboard, 028 9048 4511.

## Referral and Regional Tests

For all requests that are forwarded within Northern Ireland to the regional centres for testing the Ulster Hospital Laboratory only acts as a 'post-box'. Analysis and result reporting is the responsibility of the appropriate Regional Laboratory. For all referrals, including those sent to mainland UK, the Ulster Hospital Laboratory records details of these requests and ensures that results are reported back to the requestor.

*Please note that referrals to mainland UK are only able to be sent Monday – Thursday (excluding Public Holidays).*

## SPECIMEN COLLECTION & TRANSPORT

Appendix C: Venepuncture Guidance includes a summary of blood specimen collection. For further details please see the Trust Venepuncture Policy and the Trust Patient Identification Policy. Details for other specimen types and any required storage conditions can be found under specimen headings in each department's sections of this user manual.

Key points to remember for specimen collection:

- determine of the identity of the patient
- verify the patient meets pre-examination requirements, i.e. fasting status, medication status (time of last dose/cessation), sample collection at pre-determined time or time intervals, etc.
- ensure you have the correct sample container
- ensure both the request form and specimen have the mandatory information included
- store collected samples away appropriately and away from extremes of temperature (unless specified within this user manual) before delivery to the laboratory

All specimens for analysis must be transported to the Laboratory in either:

- a leak-proof specimen transport bag labelled with the universal Biohazard symbol *(Ulster Hospital specimens)*
- a pneumatic tube system pod *(relevant Ulster Hospital locations only)*
- a UN3373 compliant transport bag with a UN3373 logo *(All external, non-Ulster Hospital, specimens)*

All GP/community specimens sent to the Laboratories at the Ulster Hospital should be segregated for transport into 4 separate groups:

- Microbiology specimens
- Biochemistry and Haematology specimens
- Urgent and INR specimens
- All other specimens

Each group of specimens should have their own specimen transport bag. This is so that the primary sort of Laboratory specimens occurs at source, resulting in a shorter, more efficient Laboratory process and therefore a faster result turnaround time.

## Health and Safety

All biological specimens represent a potential health hazard to Healthcare staff. Please ensure that specimens are properly sealed before transportation. ***Leaking specimens and contaminated request forms or specimens must not be sent to the Laboratory.*** Drivers and Laboratory porters must follow the model rules contained in the Laboratory Health and Safety Manual [LAB MAN-18] and the Specimen Transport Guidelines [LAB MAN-48] (both available on the Trust Intranet and on request from the Ulster Hospital Laboratory).

## Pneumatic Tube System

There is a pneumatic tube system in place to transport specimens from A&E, the Acute Services Block, the Critical Care Complex, the Inpatient Ward Block and Outpatients to the Laboratory. The codes for sending specimens to the Laboratory are:

- Urgent Biochemistry – 930
- Urgent Haematology – 940
- Specimen Reception – 910/920

However, there are limitations to the types of specimens that may be sent using the pneumatic tube system. ***The following specimens must not be sent by the pneumatic tube system:***

- Blood specimens on ice (unless from Outpatients in the specially adapted carrier)
- CSF
- High Risk (e.g. COVID, TB, HIV, Hep. B, etc)
- Large volume specimens (e.g. 24 hour urine)
- Not easily repeatable specimens
- Units of blood/blood products

If the pneumatic tube system is down, alternative transport with porters must be arranged and the fault must be reported to the Estates Help Desk (Ext 82701) for Estates to action.

## High Risk Specimens

Specimens from patients known or suspected to be infected with a Category 3 Pathogen, for example Mycobacterium tuberculosis, Hepatitis B virus, HIV or the Enteric fevers must have a hazard warning Category 3 Pathogen label, “Danger of infection – take special care”, affixed to both the specimen container and request form. Clinical details highlighting the probable pathogen / nature of infection must also be included on Encompass order / request form.

High risk hazard warning Category 3 Pathogen labels can be ordered from the Laboratory store.

**Note that all High Risk Specimens must be labelled with the same minimum required details as stated in the section: Request Form and Specimen – Required Details.**

## Phlebotomy Service

A phlebotomy service is provided for certain Directorates during routine weekday operating hours.

## Laboratory Supplies

Orders for Laboratory supplies, such as specimen containers, must be placed by Friday to allow supplies to be dispatched on Monday to Wednesday of the following week. Orders can be faxed to the Laboratory on 028 9048 7131.

## Times of Specimen Collection

Emergency Bleep portering service. Specimens are transported from Ulster Hospital to

| | | | |
|---|---|---|---|
| Specimens: | Belfast Trust Laboratories at 10am and 12.30pm. Extra runs can be arranged. | | |
| Hospital Specimens: | Ulster Hospital: | Weekdays | 09:25 – 10:00; 10:30 – 11:00; 11:30 – 13:00; 13:30 – 15:00; 15:30 – 17:00 |
| | | Saturday | 09:00 – 13:00 |
| | | Sunday | 10:30 – 11:00 |
| | Ards & Bangor Hospitals: | Weekdays | 10:15 – 11:15; 13:00 – 14:00; 16:00 |
| GP Specimens: | Specimens are collected daily Monday to Friday by SEHSCT Transport staff. Details of individual times are held with the Trust Transport Manager. For enquiries contact 028 915 10151. | | |

## LABORATORY REPORTS

All results for Hospital users will be available electronically on Encompass and NI ECR as soon as results have been authorised in the Laboratory. Reports for GP surgeries will be sent via GP link (IUVO) at scheduled times throughout the day. Limited paper reports will be provided, but only for non-HSCNI entities that cannot access Encompass or NI ECR.

Results are telephoned to the wards under the following circumstances:

- All reports must be specifically requested by telephone in person by medical/nursing staff or on the request form and recorded on the Winpath Telephone Call Log / Laboratory Telephone Log [FORMS LAB-10]
- Where the result is abnormal and outside agreed telephone limits [LAB MAN-28]. ***Note: In Clinical Biochemistry results are not phoned to A&E (excluding Digoxin >2.5 ug/L, Potassium > 7.0 mmol/L & Troponin-T results >100 ng/L), ICU and SCBU – following local agreement with these areas. For all areas the Laboratory does not phone results beyond the first alert for an episode, with the exception of Haematology tests DDI and INR. Results which are concurrently abnormal as part of a patient's current episode are not phoned.***
- In response to a telephone call requesting results or, in the case of Blood Bank, when a requested product is available/ready for collection

The following points must be adhered to for the transmission of results via telephone:

- Before giving a result over the telephone the Laboratory must verify the identity of caller. The Laboratory can only give results to a doctor or a nominated member of staff in the requesting location, i.e. a nurse or receptionist. The Laboratory cannot give results directly to a patient. *Please note that it is the responsibility of the requestor to have a list of authorised staff that are able to receive results from the Laboratory.*
- When giving out telephoned results the Laboratory will state the patient' name and date of birth to ensure that it is correct. For community results they will also state the GP. If this information is correct, they will proceed to read out the patient's results along with any associated comments clearly and slowly. The Laboratory staff will also highlight any grossly abnormal results. The person receiving the results should repeat each piece of information back to the Laboratory staff member to ensure that they have heard the results correctly. *Please note that it is the responsibility of the requestor receiving the results to ensure they have a mechanism for recording the results.*
- The Laboratory will also record any telephoned results for traceability purposes.

## Advisory Services

All Laboratory disciplines provide consultative advisory services in relation to advising on choice of examinations and use of the services *(including type of sample required, clinical indications*

*and limitations of examination procedures and the frequency of requesting the examination). The service also provides* advice on individual clinical cases and professional judgments on the interpretation of the results of examinations. The advisory service promotes the effective utilization of Laboratory services and can also be used to consult on scientific and logistic matters, such as instances of failure of samples to meet acceptance criteria.

For Clinical Biochemistry clinical advice is available 24/7 from the Duty Biochemist, which is available through Switchboard (Ext. 0 or 028 9048 4511).

For Haematology & Blood Transfusion clinical advice is available 24/7 from the Consultant Haematologist on call, which is available through Switchboard (Ext. 0 or 028 9048 4511).

*Please see https://labtestsonline.org.uk/tests/blood-film for Haematology guidance - it gives details on Red Blood Cell Irregularities, etc.*

For Microbiology clinical advice regarding inpatients please send a referral for IP Consult to Microbiology through Encompass. Out of hours and community clinical advice is available from the Microbiology Consultant on call, which is available through Switchboard (Ext. 0 or 028 9048 4511).

## Measurement Uncertainty

All pathology assays carry an inevitable degree of uncertainty; the level of uncertainty is a combination of several factors (e.g. pre-analytical influences, analytical variation and biological variation).

Although some of the uncertainty can be controlled by the Laboratory it is important to recognise that variation can occur and modestly differing sequential results may not always have clinical relevance. The relevance of a particular result or a change in value must be considered in light of both the reproducibility of the method and the biological variation within the patient.

If there is doubt concerning the significance of a result or a change in sequential results, contact a member of the Laboratory or relevant clinical staff who can provide further information on measurement uncertainty.

Providing relevant clinical details at the time that the request is made can also clarify the significance of a particular result or a change in results.

## Requesting Additional Examinations ('Add Ons')

Under certain circumstances, it is possible to add tests onto samples that are already in the Laboratory, but this will depend on sample stability, tube type and remaining sample volume available. Requests for additional Biochemistry, Haematology or Microbiology examinations must be received within 4 hours of original receipt of the specimen in the Laboratory. Investigations are best performed on fresh primary specimens, where possible. Please defer any non-urgent investigations until further phlebotomy is being performed.

For add on requests via Encompass (all Hospital-based users) the requestor must generate an order within Encompass and then send the order request form to the Laboratory. All off-site requesters (non-Hospital based users), should contact the relevant Laboratory discipline for an email or fax destination for a completed request form to be sent to.

Add on requests can only be accepted if the original sample container, sample size and pre-analysis treatment are suitable for the required test. If the sample has already been used for analysis certain tests are not available as 'add ons' within Biochemistry, including hCG and tumour markers. This is because of potential carry over issues which invalidate the result.

Additional requests will not be processed based only on a telephone call.

## Delayed Examinations

If there is a serious delay in performing a diagnostic test that may compromise patient care the relevant Head BMS or Section Head will ensure that the service user is notified of the delay.

## UKAS GEN6 STATEMENT

The Laboratory utilises Winpath Enterprise (provided by Clinisys) as our Laboratory Information Management System (LIMS). As this is a regional system, covering the whole of Northern Ireland, we are currently unable to fully meet the requirements of the UKAS publication GEN 6 – Reference to accreditation and multilateral recognition signatory status.

The UKAS publication GEN 6 sets out the requirements of reports/results released by the Laboratory containing the appropriate use of UKAS logos and identifying any tests that are accredited and those that are not. Although the LIMS currently being utilised by our Laboratory could allow us to present the UKAS logo within our reports, we could not remove it from reports where we have non-accredited tests. Also, whilst it is possible to enter a small amount of additional text without any difference in formatting at the end of each report, the referencing to the accreditation of tests could potentially interfere or cause the misinterpretation of pathology results (particularly tests that already have statements at the end of the reports explaining reference ranges, clinical advice, etc.). If the text were to be added in regards to accreditation status of each test, this would also have to be site specific or would have to state the accreditation status of all Laboratories within the region.

The Laboratory, along with our regional colleagues, have risk assessed this matter. Although we are not able to present this information on our reports the Laboratory's user manual presents full details of our accreditation, including a link to the UKAS page for our up-to-date schedule of accreditation, and details any tests that are currently out of scope.

Additionally, if a user presents a request to the Laboratory for analysis the user is entering into an agreement for testing and as such are agreeing to the fact that any reports associated with this testing cannot be regarded as having been issued under its accreditation, and therefore it is not covered by the multilateral agreements (i.e. EA MLA, ILAC MRA and IAF MLA) that UKAS is a signatory of.

## CONFIDENTIALITY OF SERVICE USER INFORMATION & CONSENT

The Ulster Hospital Laboratories follow the South Eastern Health and Social Care Trust Code of Practice on Protecting the Confidentiality of Service User Information.

The Ulster Hospital Laboratories follow the South Eastern Health and Social Care Trust Policy on Consent to Examination, Treatment or Care. Consent is implied by the receipt of the sample and request form from the requesting clinician at source. Reflex testing may be carried out on certain analytes, depending on the initial result. It is assumed the original consent is sufficient.

## USER & PATIENT FEEDBACK

The Laboratory welcomes feedback from both service users and patients. If you would like to provide any feedback, including in relation to aiding the Laboratory in the selection of the examination

methods and the interpretation of examination results please contact the Laboratory Quality Manager, Darren Crawford – darren.crawford@setrust.hscni.net / 028 904 11565.

## COMPLAINTS PROCEDURE

The Laboratory's Complaints Procedure [LAB MAN-32] is based upon the Trust's Policy for Management & Handling of Complaints.

If you have a complaint, please contact a member of Laboratory staff who will try to rectify the issue. If you would prefer, you can also raise complaints via the Trust website or by contacting the Trust Complaints Department:

| | |
|---|---|
| Address: | Complaints Department<br>South Eastern HSC Trust<br>Lough House<br>Ards Community Hospital<br>Church Street<br>Newtownards<br>BT23 4AS. |
| Phone: | 028 9056 1427 |
| Email: | complaints@setrust.hscni.net |

For further details on how to pursue a complaint are detailed on

*The full Laboratory Complaints Procedure [LAB MAN-32] is available from the Laboratory upon request.*

# CLINICAL BIOCHEMISTRY

*A UKAS accredited medical laboratory No. 8029*

*The laboratory's full schedule of accreditation, listing accredited tests, can be found on the UKAS website. Any tests not on the schedule are highlighted in the test and reference values section.*

## CLINICAL BIOCHEMISTRY CONTACT DETAILS

| | | |
|---|---|---|
| **CONSULTANT HEAD OF CLINICAL BIOCHEMISTRY:** | Dr Kathryn Ryan | 028 9041 1580 / Ext. 11706<br>kathryn.ryan@setrust.hscni.net |
| **CONSULTANT CLINICAL BIOCHEMIST:** | Dr Derek McKillop | 028 9041 1706 / Ext. 21556<br>derek.mckillop@setrust.hscni.net |
| **CLINICAL BIOCHEMISTRY HEAD BIOMEDICAL SCIENTIST:** | Gillian Law | 028 904 1 1576 / Ext. 21545<br>gillian.law@setrust.hscni.net |

**GENERAL ENQUIRIES:** 028 9041 1701 / Ext. 21554

**OUT-OF-HOURS BIOMEDICAL SCIENTIST:** 078 7204 8346 or 63634

## TURNAROUND TIMES

Results for **emergency** requests are available **90 minutes** after receipt by the Laboratory. **Inpatient requests** received between 9am and 4pm will have results reported within **4 hours** of specimen receipt, unless the expected turnaround time is stated in hours or >1 day in the test section overleaf. **All other requests** are reported within the **expected turnaround times stated in the test section overleaf**. The Laboratory aims to process 95% of requests within these expected turnaround times, however turnaround times for some requests may be extended if they require further investigation.

## URGENT REQUESTS

As stated in the general information section, only certain tests are available as urgent requests. The tests that are available as urgent requests are shown below. In addition, urgent requests must be sent in a yellow urgent Clinical Biochemistry specimen bag (Encompass orders) or on a Clinical Biochemistry yellow urgent request form (manual orders). For clinical emergency cases, where an exceptional response is required, i.e. a turnaround time of less than 90 minutes, the requestor must call 07872048346 or 63634 to highlight the request to the department.

| CLINICAL BIOCHEMISTRY TESTS AVAILABLE AS URGENT REQUESTS | | |
|---|---|---|
| Ammonia | Digoxin | Salicylate |
| Amylase | Electrolytes-creatinine | Theophylline |
| Bile Acid | Ethanol (Alcohol) | Troponin T HS |
| Bilirubin – Total & Direct | Gentamicin | |
| Blood glucose | HCG (if clinically necessary) | |
| Bone profile | Liver function tests | |
| Calcium | Magnesium | |
| CSF (Glucose, Lactate, Protein & Xanthochromia) | Osmolality | |
| | Paracetamol | |

## TESTS AND REFERENCE VALUES

**This section includes the test repertoire for the Clinical Biochemistry only.**

**If you are looking for a specific test please type the "test name" or a " keyword" in the text search box on the tool bar above and press enter ( ↵ ) (or use 'Crtl+F' keyboard shortcut if search box not displayed).**

**If you cannot find the test you are looking for it is likely that the test may be sent to one of the Regional Laboratories in Belfast, i.e. Immunology. To find information regarding a test carried out by one of the Regional Laboratories in Belfast please go to https://belfasttrust.hscni.net/service/laboratory-services/ and open the Belfast Trust Laboratories User Manual.**

**Again, if you are looking for a specific test please type the "test name" or a " keyword" in the text search box on the tool bar above (or use 'Crtl+F' keyboard shortcut if search box not displayed).**

**If you cannot find the test you are looking for by either of these 2 ways, please contact the Ulster Hospital Laboratory.**

*Note that some reference intervals are age-related – for these reference intervals please refer to the Age Related Reference Intervals section.*

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| ACTH | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| ALDOSTERONE | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| ALKALINE PHOPHATASE ISOENZYMES | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| ALPHA-1-ACID GLYCOPROTEIN | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| ALPHA-1- ANTITRYPSIN | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| ALPHA-FETO PROTEIN<br>Plasma | BLOOD  Adult:<br>Lithium Heparin gel tube – 3.5ml<br> Paediatric:<br>Lithium Heparin tube – 400µl | Age related | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| ALPHA GALACTOSIDASE (Fabry's Disease) | BLOOD  EDTA tube – 4ml | | R* |
| ALPHA SUB UNIT (ASUI) | BLOOD  Gel tube – 5ml | <1 IU/l<br>menopause mid cycle peak <3 IU/l | R* |
| ALUMINIUM | See BHSCT Laboratory User Manual for specimen information<br>*(Contact Ext 21522 for trace metal blood tubes)* | See BHSCT Laboratory User Manual for reference interval information | R* |
| AMIKACIN | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| AMINO ACID | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| AMMONIA | BLOOD<br>Adult:<br><br>EDTA tube – 4ml<br>**Tube should be filled completely**<br>Paediatric:<br><br>EDTA tube – 400µl<br>*A free-flowing venous blood sample should be collected into specimen tubes containing EDTA as anticoagulant. Drawing blood through a small indwelling catheter may cause haemolysis and hence spuriously elevated ammonia; ideally blood obtained this way should be avoided.*<br>***All specimens for ammonia analysis should be transported to the laboratory as soon as possible, ideally within 15 minutes of collection.***<br>During out-of-hours periods please confirm the request with the out-of-hours BMS – 07872048346 or 63634 | <50 umol/l<br>(Also age related)<br><br>*Note: causes of artefactual increase in ammonia:*<br>• *poor specimen quality/haemolysis*<br>• *difficult venepuncture*<br>• *skin contamination*<br>• *contaminated tube*<br>• *delayed analysis/protein breakdown*<br><br>***Undiagnosed Hyperammonaemia:***<br>*Diagnosis and Immediate Management*<br>*https://bimdg.org.uk/wp-content/uploads/2024/12/Hyperammonaemiaand_manage_2016_415469_09092016.pdf* | 1 day |
| AMPHETAMINE | See BHSCT Laboratory User Manual for specimen information | | R* |
| AMYLASE | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml | 28-100 U/l | 1 day |
| AMYLASE/ CREATININE RATIO | URINE<br><br>Random urine in yellow Sarstedt urine vacutainer | 2-5% | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| ANDROSTENEDIONE | BLOOD<br><br>Clotted blood tube – 6ml (must be filled)<br>*(Gel tube not suitable)* | See BHSCT Laboratory User Manual for reference interval information | R* |
| ANGIOTENSIN CONVERTING ENZYMES (ACE) | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| APOLIPROTEINS | BLOOD<br> Gel tube – 5ml | | R* |
| ARYLSULPHATASE | BLOOD<br> EDTA tube – 4ml X 2 | | R* |
| AST/ALT RATIO<br>AST<br><br>ALT | BLOOD<br>Adults:<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl | >1.5 suggests liver damage<br>Male: ≤40 U/l, Female: ≤32 U/l<br>(Also age & pregnancy related)<br>Male: <41 U/l, Female: <33 U/l<br>(Also age & pregnancy related)<br><br>*Note: Aminotransferase activity may be falsely low in patients with Vitamin B6 deficiency.* | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| B2 MICROGLOBULIN | BLOOD<br> Gel tube – 5ml | <60yrs: 0.8-2.4 mg/l<br>≥60yrs: ≤3.0 mg/L | 24 hours |
| BENCE JONES PROTEIN<br>(for the investigation of amyloid and nephrotic syndrome)<br>*Not UKAS accredited* | URINE<br> Early morning urine in yellow Sarstedt urine vacutainer | Not normally detected | R* |
| BENZODIAZEPINE | See BHSCT Laboratory User Manual for specimen information | | R* |
| BILE ACIDS | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>**Prandial (non-fasted) samples are recommended for assessment of intrahepatic cholestasis pregnancy (ICP)** | <19 umol/l<br><br>Royal College of Obstetricians & Gynaecologists guidance: Intrahepatic cholestasis of pregnancy (Green-top Guideline No. 43) \| RCOG | 1 day |
| BILIRUBIN<br>Total<br>Direct*<br>**Not UKAS accredited* | BLOOD<br>Adults:<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl | Total: <21 umol/l (Also age related)<br>Direct: <3 umol/l (Also age related) | 1 day |
| BONE MARKERS<br>BAP ostase<br>Crosslaps<br>P1NP | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| BONE PROFILE<br>Albumin<br>Alkaline Phosphatase<br>Calcium<br>Calcium (adjusted)<br>Phosphate | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl | <br>35-50 g/l (Also age related)<br>30-130 U/l (Also age & pregnancy related)<br>2.2-2.6 mmol/l (Also age related)<br>2.2-2.6 mmol/l<br>0.8-1.5 mmol/l (Also age related) | 1 day |
| β-HYDROXYBUTYRATE | BLOOD<br> Lithium Heparin gel tube – 3.5ml | 0.02-0.27 mmol/l | 1 day |
| CADMIUM | See BHSCT Laboratory User Manual for specimen information<br>*(Contact Ext 21522 for trace metal blood tubes)* | See BHSCT Laboratory User Manual for reference interval information | R* |
| CAERULOPLASMIN | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| CALCITONIN | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| CALCIUM (Adjusted) | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br>Lithium Heparin Tube – 400µl<br><br>URINE<br>24h collection in special bottle (40ml 30% HCl)<br>Please contact Lab (Ext 21522) | <br>2.2-2.6 mmol/l<br>(Often a marked fall after birth with lowest level at 24-48h of age)<br><br><br><br><br><br>2.5-7.5 mmol/24h | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| CALCIUM/ CREATININE RATIO | URINE<br>Please contact Lab for special bottle (Ext 21522) | Reference interval age related | 1 day |
| CALCIUM/ CREATININE CLEARANCE RATIO<br>*Not UKAS accredited* | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>AND paired URINE<br>24h collection in special bottle (40ml 30% HCl) – please contact Lab for container (Ext 21522)<br>24h collection is preferable but a random urine is acceptable | <0.01 Result suggests FHH<br>0.01 - 0.02 Further investigation required<br>>0.02 Result NOT suggestive of FHH | 1 day |
| CALCULI | See BHSCT Laboratory User Manual for specimen information | | R* |
| CALPROTECTIN | FAECES<br> Small faeces specimen | ≥ 16 Years of Age:<br><50 ug/g – IBD unlikely<br>50-150 ug/g – Repeat in 2 wks, with patient off NSAID, aspirin or PPI, if still 50-150 ug/g refer to GI OPD<br>>150 ug/g – IBD likely, refer to gastroenterologist<br><br>< 16 Years of Age:<br>Reference ranges in Pediatrics are not well established | 8 days |
| CANNABANOIDS | See BHSCT Laboratory User Manual for specimen information | | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| CARBAMAZEPINE | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin Tube – 400µl | 4 -12 mg/l (single dose)<br>4 - 8 mg/l (multiple dose) | 28 hours |
| CARBOXYHAEMOGLOBIN (CARBON MONOXIDE) | BLOOD<br>Whole blood in balanced (blood gas) heparin syringe or a non-gel heparin tube (must be filled to exclude air)<br>Samples must be received within 2 hours of collection | Adult non-smokers: 0 - 2 %<br>Adult average smokers: 2.1 – 4.2%<br>Heavy smoker: 8-9% | 1 day |
| CARCINO-EMBRYONIC ANTIGEN (CEA) | BLOOD<br> Lithium Heparin gel tube – 3.5ml | <5.0 ug/L (Non smokers)<br><5.5 ug/L (Smokers) | 1 day |
| CA-125 | BLOOD<br> Lithium Heparin gel tube – 3.5ml | <35 U/ml | 1 day |
| CA-19-9 | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| CATECHOLAMINES<br>Adrenaline<br>Noradrenaline<br>Dopamine | See BHSCT Laboratory User Manual for specimen information<br>*Contact Lab for bottle (Ext 21522)* | See BHSCT Laboratory User Manual for reference interval information | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| CHLORIDE | URINE  24h collection of urine – no preservative | 110-250 mmol/24h | 1 day |
| CHOLINESTERASE<br>Genotyping and Phenotyping | BLOOD  EDTA tube – 4ml | | R* |
| CHROMIUM | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| COBALT | See BHSCT Laboratory User Manual for specimen information<br>*(Contact Ext 21522 for trace metal blood tubes)* | See BHSCT Laboratory User Manual for reference interval information | R* |
| COMPLEMENT<br>C3<br>C4 | BLOOD  Gel tube – 5ml | <br>0.75-1.65 g/l<br>0.14-0.54 g/l | 1 day |
| COPPER | See BHSCT Laboratory User Manual for specimen information<br>*(Contact Ext 21522 for trace metal blood tubes)* | See BHSCT Laboratory User Manual for reference interval information | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| CORTISOL | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl X 2<br><br>URINE<br>See BHSCT Laboratory User Manual for specimen information | Circadian Rhythm:<br>Morning hours (6-10am):<br>166 - 507nmol/L<br>Afternoon hours (4-8pm):<br>74 - 291 nmol/L<br><br>See BHSCT Laboratory User Manual for urine reference interval information | 1 day<br><br>R* |
| C-PEPTIDE | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| C-REACTIVE PROTEIN | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl | <5 mg/l | 1 day |
| CREATININE | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl | Male: 59-104 umol/l<br>Female: 45-84 umol/l<br><br>Age related | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| CREATINE KINASE | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl | Male: 39 - 308 U/l<br>Female: 26 - 192 U/l | 1 day |
| CREATININE CLEARANCE |  BLOOD<br>Lithium Heparin gel tube – 3.5ml<br>**AND**<br> URINE<br>24h collection of urine – no preservative | 66-143 ml/min | 1 day |
| CRYOGLOBULINS<br>*Not UKAS accredited* | BLOOD<br>Contact Lab (Ext 21522) | Not normally detected | 14 days |
| CSF<br>Protein<br>Glucose<br><br>Lactate<br><br><br>Xanthochromia<br><br>Amino Acids | *See Test Protocols (page 97 – Microbiology)*<br>CSF<br>Sterile universal container<br>**IF REQUESTING CSF SPECTROPHOTOMETRY SAMPLES MUST BE PROTECTED FROM LIGHT – PLACE THEM IN A THICK BROWN ENVELOPE OUTSIDE THE USUAL SPECIMEN BAG**<br>BLOOD<br>See BHSCT Laboratory User Manual for specimen information | Adult: 0.15-0.45 g/l<br>Adult: 2.2-3.9 mmol/l<br>Child: 3.3-4.4 mmol/l<br>(60-70% plasma glucose)<br>Adult: 1.1-2.4 mmol/L<br>Neonate: 1.1-6.7 mmol/L<br>3-10 days: 1.1-4.4 mmol/L<br>>10 days: 1.1-2.8 mmol/L<br>Not normally detected (Bilirubin)<br>See BHSCT Laboratory User Manual for reference interval information | 1 day<br>1 day<br><br><br>1 day<br><br><br><br>1 day<br>R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| CYCLOSPORIN | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| CYSTINE | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| DEHYDROEPIANDROSTERONE SULPHATE (DHEAS) | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| DIGOXIN | BLOOD<br> Lithium Heparin gel tube – 3.5ml *(6-8hrs post dose)*<br>Paediatric:<br> Lithium Heparin tube – 400µl *(6-8hrs post dose)* | *Hypokalaemia potentiates toxicity*<br>Therapeutic range: 0.5-2.0 ug/l<br>Target range in heart failure: 0.5-1.0 ug/l<br><br>**Digoxin levels are unreliable if obtained earlier than 6hrs after a dose of digoxin.**<br><br>**Digoxin blood levels should be ideally taken 6-8hrs after the last dose of digoxin was administered.** | 1 day |
| DRUGS OF ABUSE SCREEN<br>Cannabanoids<br>Cocaine Metabolites<br>LSD<br>Opiates | See BHSCT Laboratory User Manual for specimen information | | R* |
| ELECTROLYTES *(plasma)*<br>Sodium<br>Potassium<br>Chloride<br>Bicarbonate<br>Urea<br>Creatinine | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl | 135-146 mmol/l<br>3.5 – 4.6 mmol/l (Also age related)<br>95-108 mmol/l<br>22-29 mmol/l (Age related)<br>2.5-7.8 mmol/l (Also age related)<br>Male: 59-104 umol/l (Also age related)<br>Female: 45-84 umol/l (Also age related)<br>Anion gap calculator:<br>https://sydpath.com.au/anion-gap-calculator/ | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| ETHANOL (ALCOHOL) | BLOOD<br> Lithium Heparin gel tube – 3.5ml | | 1 day |
| ETHYLENE GLYCOL | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| FAECAL ELASTASE | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| FERRITIN | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl ***(filled)*** | Male ≥60: 30-400 ug/L<br>Female ≥60: 15-330 ug/L<br>(Also age related) | 1 day |
| FLUID<br>*Not UKAS accredited*<br><br>Fluid appearance<br>Sodium<br>Potassium<br>Chloride<br>Total Protein<br>Urea<br>Creatinine<br>Amylase<br>Triglyceride<br>LDH<br>Cholesterol<br>Albumin/gradient<br>Bilirubin | FLUID<br>*(Pleural, Peritoneal & Miscellaneous)*<br><br>White top universal container – 5ml | See Fluid Interpretation of Results and Comments document on the Intranet. | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| FLUID GLUCOSE<br>*Not UKAS accredited* | FLUID<br>*(Pleural, Peritoneal & Miscellaneous)*<br><br>White top universal container – 5ml | See Fluid Interpretation of Results and Comments document on the Intranet. | 1 day |
| FLUID pH<br>*Not UKAS accredited* | FLUID<br>*(Pleural, Peritoneal & Miscellaneous)*<br><br>GEM EasyDraw Syringe – 1.5ml<br>***Do not send on ice, as can adversely affect results*** | See Fluid Interpretation of Results and Comments document on the Intranet. | 1 day |
| FREE ANDROGEN INDEX (FAI)<br>*Not UKAS accredited* | BLOOD<br> Lithium Heparin gel tube – 3.5ml | Male 20 - 49 yrs: 35 - 92.6%<br>Male ≥ 50 yrs: 24.3 - 72.1%<br><br>Female 20 – 49 yrs: 0.3 - 5.62%<br>Female ≥ 50 yrs: 0.19 - 3.63% | 5 days |
| FREE LIGHT CHAINS | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| FREE T3 | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl | 3.1-6.8 pmol/l (Also age related) | 5 days |
| FRUCTOSAMINE | BLOOD<br> Gel tube – 5ml | | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| FSH | BLOOD<br> Lithium Heparin gel tube – 3.5ml | Male: 1.5 – 12.4 U/l<br>Female:<br>Follicular: 3.5-12.5 U/l<br>Luteal: 1.7-7.7 u/l<br>Ovulatory peak: 4.7-21.5 U/l<br>Post menopause: 25.8-134.8 U/L | 3 days<br>*(Please note that some reports, which require clinical comments, will take longer)* |
| GALACTOSE-1-PHOSPHATE MONITORING TEST | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| GALACTOSE-1-PHOSPHATE URIDYL TRANSFERASE (GAL-1-PUT) SCREENING TEST | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| GAUCHER DISEASE |  EDTA tube – 4ml **(filled)** | | R* |
| GENTAMICIN | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl | <1mg/l<br>*(Does not apply to Hartford Nomogram, Endocarditis (Guidelines for the prescribing, administration and monitoring of intravenous aminoglycosides in adults)or initial Neonatal dosing (Prescribing, Administration and Monitoring of Gentamicin in Neonates)* | 28 hours |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| GLUCOSE | BLOOD  Fluoride EDTA tube – 2ml | 4.1 – 6.1 mmol/l (fasting)<br>*Fasting plasma glucose in the 6.1-6.9 mmol/l range is indicative of impaired fasting glucose. If resources allow, such individuals should undergo a GTT (see Test Protocols).* | 1 day |
| GLUCOSE-6-PHOSPHATE DEHYDROGENASE (G6PD) | See BHSCT Laboratory User Manual for specimen information *(Haematology section)* | | R* |
| GLUCAGON | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| GLUCOSE TOLERANCE TEST (GTT) | BLOOD  Fluoride EDTA tube – 2ml | See Test Protocols for GTT protocol | 1 day |
| GROWTH HORMONE | See BHSCT Laboratory User Manual for specimen information<br>*See Test Protocols for Growth Hormone Excess & Deficiency protocols* | | R* |
| GUT AND ISLET HORMONE ASSAYS<br>Calcitonin /<br>Chromogranin A /<br>Gastrin /<br>Glucagon /<br>Insulin /<br>Pancreatic Polypeptide /<br>Vasoactive Intestinal Peptide | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| HbA1c (HAEMOGLOBIN A1C) | BLOOD  EDTA tube – 2ml **Tube must be at least half filled** | 20 – 41mmol/mol <u>*Diagnostic Criteria:*</u> *≥48 mmol/mol diagnostic for type 2 diabetes in symptomatic patients* *41 – 47mmol/mol high diabetes risk* *≤41 mmol/mol review individual risk* | 3 days |
| HAPTOGLOBIN | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| HEAVY METAL SCREEN | See BHSCT Laboratory User Manual for specimen information *(Contact Ext 21522 for trace metal blood tubes)* | See BHSCT Laboratory User Manual for reference interval information | R* |
| HEXAMINADASE ENZYME | BLOOD  EDTA tube – 4ml | | R* |
| HIGH DENSITY LIPOPROTEIN (HDL) | BLOOD  Lithium Heparin gel tube – 3.5ml | 1-2.5 mmol/L (Also age related) | 1 day |
| HOMOCYSTEINE | See BHSCT Laboratory User Manual for specimen information ***Please contact Ext. 21522 before sending sample*** | See BHSCT Laboratory User Manual for reference interval information | R* |
| HOMOGENTISIC ACID | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| HORMONE PROFILE (FEMALE)<br>FSH<br><br><br><br>Oestradiol | BLOOD<br> Lithium Heparin gel tube – 3.5ml | <br><br>Follicular: 3.5-12.5 U/l<br>Luteal: 1.7-7.7 u/l<br>Ovulatory peak: 4.7-21.5 U/l<br>Post menopause: 25.8-134.8 U/L<br><br>Follicular: 114-332 pmol/L<br>Luteal: 222-854 pmol/L<br>Ovulatory Peak: 222-1959 pmol/L<br>Post menopause <505 pmol/L | 3 days<br>*(Please note that some reports, which require clinical comments, will take longer)* |
| HORMONE PROFILE (MALE)<br>FSH<br>LH<br>Testosterone | BLOOD<br> Lithium Heparin gel tube – 3.5ml | <br><br>1.5 – 12.4 U/L<br>1.7-8.6U/L<br>8.6-29.0 nmol/L | 3 days<br>*(Please note that some reports, which require clinical comments, will take longer)* |
| HUMAN CHORIONIC GONADOTROPHIN (BHCG) | BLOOD<br> Lithium Heparin gel tube – 3.5ml | < 5 U/l | 1 day |
| HYDROXYINDOLE ACETIC ACID (5-HIAA) | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| 17-HYDROXYPROGESTERONE | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| 5 HYDROXYTRYPTAMINE | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| HYPOGLYCAEMIC ADMISSIONS | See Test Protocols | | 1 day<br>R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| ICU PROFILE<br><br>Sodium<br>Potassium<br>Chloride<br>Urea<br>Creatinine<br><br>Bicarbonate<br><br>Albumin<br>ALP<br>AST<br><br>ALT<br><br>GGT<br><br>Calcium<br>Calcium (adjusted)<br>eGFR<br>Magnesium<br>Phosphate | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml | <br><br>135-146 mmol/l<br>3.5-4.6 mmol/l (Also age related)<br>95-108 mmol/L<br>2.5-7.8 mmol/l (Also age related)<br>Male: 59-104 umol/l (Also age related)<br>Female: 45-84 umol/l (Also age related)<br>22-29 mmol/L (Also age related)<br><br>35-50 g/l (Also age related)<br>30-130 U/l (Also age related)<br>Male: ≤40 U/l, Female: ≤32 U/l *<br>(Also age related)<br>Male: <41 U/l, Female: <33 U/l *<br>(Also age related)<br>Male: 10-71 U/l, Female: 6-42 U/l<br>(Also pregnancy related)<br>2.2-2.6 mmol/l (Also age related)<br>2.2-2.6 mmol/l<br>≥60ml/min/1.73m$^2$<br>0.7-1.0 mmol/l (Also age related)<br>0.8-1.5 mmol/l (Also age related)<br><br>** Note: Aminotransferase activity may be falsely low in patients with vitamin B6 deficiency.* | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| IMMUNOGLOBULINS<br>IgG<br>IgA<br>IgM | BLOOD<br>Adult:<br> Gel tube – 5ml<br>Paediatrics:<br> Gel blood tube – 400µl ***(filled)*** | >45yrs: 6.0-16.0 g/l (also age related)<br>>45yrs: 0.8-4.0 g/l (also age related)<br>>45yrs: 0.5-2.0 g/l (also age related) | 3 days |
| INSULIN | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| INSULIN-LIKE GROWTH FACTOR (IGF-1) | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| IRON | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl X 2 ***(filled)***<br>*OD levels at 2hrs (children) or 4-6hrs (adults)* | 10-30 umol/l (Also age related)<br><br><90umol/l – mild overdose<br>90-180umol/l – severe overdose<br>>180umol/l – very severe overdose | 1 day |
| IRON PROFILE<br>Iron<br>Transferrin<br>% Saturation<br><br>Ferritin | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin tube – 400µl X 2 ***(filled)*** | 10-30 umol/l (Also age related)<br>2.0-3.6 g/l (Also age related)<br>Male ≥16yrs: 16-50%<br>Female ≥16yrs: 16-40%<br>Male: 30-400 ug/l<br>Female 19 to <60yrs old: 15-150 ug/l<br>Female ≥60yrs old: 15-330 ug/l | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| LACTATE | BLOOD<br> Fluoride EDTA tube – 2ml | <16yrs old: 0.6-2.5 mmol/l<br>Adult: 0.5-2.2 mmol/l | 1 day |
| LACTATE DEHYDROGENASE (LDH) | BLOOD<br> Lithium Heparin gel tube – 3.5ml | Male: 135-225 U/l<br>Female: 135-214 U/L<br>Also age related | 1 day |
| LAMOTRIGINE | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| LAXATIVE SCREEN | FAECES / URINE<br> Random faeces/urine<br>(White topped universal) | | R* |
| LEAD | See BHSCT Laboratory User Manual for specimen information<br>*(Contact Ext 21522 for trace metal blood tubes)* | See BHSCT Laboratory User Manual for reference interval information | R* |
| LIPID PROFILE<br>Triglyceride<br>Cholesterol<br>HDL cholesterol<br>LDL cholesterol<br>CHOL: HDL ratio<br>Non-HDL | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Fasting specimen | <br>0.4-1.7 mmol/l (Also age related)<br>2.8-5.0 mmol/l (Also age related)<br>1-2.5 mmol/l (Also age related)<br><3 mmol/l<br>2-5<br>*Reference intervals refer to fasting samples – follow NICE CG181* | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| LIPOPROTEIN (a)<br>*Not UKAS accredited* | <br>BLOOD<br>Gel tube – 5ml | The cardiovascular risk conferred by Lp (a) is graded as follows:<br>32 - 90 nmol/L = minor<br>91 - 200 nmol/L = moderate<br>201 - 400 nmol/L = high<br>>400 nmol/L = very high<br>*(HEART UK Consensus statement 2019)* | 5 days |
| LITHIUM | BLOOD<br><br>Gel tube – 5ml **(Specimen 12h post dose)** | Prophylaxis: 0.4-1.0 mmol/l (≤65 yr old)<br>0.4-0.8 mmol/l (>65 yr old)<br>Acute mania: <1.2 mmol/l<br>>5mmol/l: haemodialysis required<br>>3mmol/l: consider haemodialysis if pt toxic | 1 day |
| LIVER PROFILE<br>Albumin<br>Total Bilirubin<br><br>ALP<br><br>AST<br><br>ALT<br><br>GGT | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br>Lithium Heparin Tube – 400µl | <br>35-50 g/l (Also age related)<br><21 umol/l (Also age & pregnancy related)<br>30-130 U/l (Also age & pregnancy related)<br>Male: ≤40 U/l, Female: ≤32 U/l *<br>(Also age & pregnancy related)<br>Male: <41 U/l, Female: <33 U/l *<br>(Also age & pregnancy related)<br>Male: 10-71 U/l, Female: 6-42 U/l<br>(Also pregnancy related)<br>** Note: Aminotransferase activity may be falsely low in patients with vitamin B6 deficiency.* | 1 day |
| LUTENISING HORMONE (LH) | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml | Male: 1.7-8.6 U/l<br>Female:<br>Follicular: 2.4-12.6 U/l<br>Luteal: 1.0-11.4 U/l<br>Ovulatory peak: 14-95.6 U/l<br>Post menopause: 7.7-58.5 U/L | 3 days |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| MAGNESIUM |  BLOOD<br>Lithium Heparin gel tube – 3.5ml<br>:<br> Paediatric<br>Lithium Heparin Tube – 400µl<br> URINE<br>24h collection of urine – acid preservative | 0.7-1.0 mmol/l<br>Also age related<br>2.4-6.5 mmol/24h | 1 day |
| MANGANESE | See BHSCT Laboratory User Manual for specimen information<br>*(Contact Ext 21522 for trace metal blood tubes)* | See BHSCT Laboratory User Manual for reference interval information | R* |
| MERCURY | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| METHAEMOGLOBIN | BLOOD<br>Whole blood in balanced (blood gas) heparin syringe or a non-gel heparin tube (must be filled to exclude air)<br>Samples must be received within 2 hours of collection | 0-2.0% | 90 minutes |
| METHANOL | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| METHOTREXATE | See BHSCT Laboratory User Manual for specimen information | | R* |
| METHYLMALONIC ACID | BLOOD<br> Lithium Heparin gel tube – 1ml | | R* |

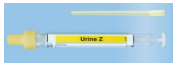
| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| MICROALBUMINURIA | URINE<br><br>Random urine in yellow Sarstedt urine vacutainer | <3.0 mg/mmol creatinine | 3 days |
| MONOPROLACTIN | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml | Male: 63 – 245mU/l<br>Female: 75 – 381mU/L<br>*Note: Monoprolactin is only reported if Total Prolactin >700mU/L – monoprolactin is the biologically active fraction* | 8 days |
| MUCO-POLYSACCHARIDE SCREEN | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| MUCO-POLYSACCHARIDES (MPS I, MPS II & MPS VI) | BLOOD<br><br>EDTA tube – 4ml X 2 ***(filled)***<br><br>URINE<br><br>10ml random urine yellow Sarstedt urine vacutainer ***(filled)*** | | R* |
| NICKEL | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| NT pro BNP | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml | Age related – *see age related reference range section* | 1 day |
| OESTRADIOL | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml | Male:<br><159 pmol/L<br><br>Female:<br>Follicular: 114-332 pmol/L<br>Luteal: 222-854 pmol/L<br>Ovulatory Peak: 222-1959 pmol/L<br>Post menopause <505 pmol/L | 1 day<br>*(Please note that some reports, which require clinical comments, will take longer)* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| ONCOLOGY PROFILE<br>Sodium<br>Potassium<br>Chloride<br>Urea<br>Creatinine<br><br>Bicarbonate<br><br>Albumin<br>Total Bilirubin<br>ALP<br>AST<br><br>ALT<br><br>GGT<br><br>Calcium<br>Calcium (adjusted)<br>eGFR<br><br>LDH<br><br><br><br>Magnesium<br>Phosphate | BLOOD<br> Lithium Heparin gel tube – 3.5ml | <br>135-146 mmol/l<br>3.5-4.6 mmol/l (Also age related)<br>95-108 mmol/L<br>2.5-7.8 mmol/l (Also age related)<br>Male: 59-104 umol/l (Also age related)<br>Female: 45-84 umol/l (Also age related)<br>22-29 mmol/L (Also age related)<br><br>35-50 g/l (Also age related)<br><21 umol/l (Also age & pregnancy related)<br>30-130 U/l (Also age & pregnancy related)<br>Male: ≤40 U/l, Female: ≤32 U/l *<br>(Also age & pregnancy related)<br>Male: <41 U/l, Female: <33 U/l *<br>(Also age & pregnancy related)<br>Male: 10-71 U/l, Female: 6-42 U/l<br>(Also pregnancy related)<br>2.2-2.6 mmol/l (Also age related)<br>2.2-2.6 mmol/l<br>≥60ml/min/1.73m$^2$<br><br>Male: 135-225 U/l<br>Female: 135-214 U/L<br>(Also age related)<br><br>0.7-1.0 mmol/l (Also age related)<br>0.8-1.5 mmol/l (Also age related)<br><br>** Note: Aminotransferase activity may be falsely low in patients with vitamin B6 deficiency.* | 1 day |
| OPIATES | See BHSCT Laboratory User Manual for specimen information | | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| ORGANIC ACIDS | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| OSMOLALITY |  BLOOD Lithium Heparin gel tube – 3.5ml<br> Paediatric: Lithium Heparin Tube – 400µl<br>URINE<br> Random urine in yellow Sarstedt urine vacutainer | 275-295 mosm/kg<br><br>Osmolality gap calculator: https://www.mdcalc.com/calc/91/serum-osmolality-osmolarity | 1 day |
| OXALATE | See BHSCT Laboratory User Manual for specimen information | | R* |
| PARACETAMOL | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>*(Specimen >4hrs post-OD)* | Therapeutic levels at 4hr: <10 mg/L<br><br>Please refer to guidance on Treating paracetamol overdose with intravenous acetylcysteine (3rd September 2012) | 1 day |
| PARAQUAT | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| PERICARDIAL FLUID (fluid)<br>*Not UKAS accredited*<br><br>LDH<br>Total Protein | White top universal container – 5ml | See Fluid Interpretation of Results and Comments document on the Intranet. | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| PERITONEAL/ASCITIC (fluid)<br>*Not UKAS accredited*<br><br>Amylase<br>Albumin<br>LDH<br>Total Protein<br>Triglyceride<br><br><br>Blood<br>Albumin | White top universal container – 5ml<br><br> Blood sample required for calculation of Ascites Albumin Gradient | See Fluid Interpretation of Results and Comments document on the Intranet. | 1 day |
| PLEURAL (fluid)<br>*Not UKAS accredited*<br><br><br>pH<br><br><br><br><br>Cholesterol<br>LDH<br>Total Protein<br>Triglyceride<br>Glucose | FLUID<br><br>GEM EasyDraw Syringe – 1.5ml<br>***Do not send on ice, as can adversely affect results***<br><br>White top universal container – 5ml | See Fluid Interpretation of Results and Comments document on the Intranet. | 1 day |
| PHENOBARBITONE | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| PHENYTOIN | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin Tube – 400µl<br>**Specimen >8hrs post dose** | 10-20 mg/l | 28 hours |
| PHOSPHATE | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin Tube – 400µl X 2 ***(fill)*** | 0.8-1.5 mmol/l<br>(Also age related) | 1 day |
| PHOSPHATE |  URINE<br>24h collection in special bottle (40ml 30% HCl) Contact Lab (Ext 21522) | 13-42 mmol/24h | 1 day |
| POMPE DISEASE | BLOOD<br> EDTA tube – 4ml ***(filled)*** **OR**<br>Dried blood spot kit (available on request from Specimen Reception – Ext. 21522) | | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| PORPHYRINS | BLOOD<br>Contact Lab (Ext 21512)<br>***All samples must be shielded from light (envelope/tinfoil) & sent to Lab immediately***<br><br>EDTA tube – 4ml<br>URINE<br><br>Random urine in yellow Sarstedt urine vacutainer<br>FAECES<br><br>Fresh faeces specimen | [Cardiff Porphyria Service Cardiff – Porphyria Information] | R* |
| POTASSIUM | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br><br>Lithium Heparin Tube – 400µl<br>URINE<br><br>24h collection of urine – no preservative | 3.5-4.6 mmol/l (Also age related)<br><br>25-125 mmol/24h | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| PROGESTERONE | BLOOD  Lithium Heparin gel tube – 3.5ml | Ovulation can be confirmed retrospectively by measurement of serum progesterone in midluteal phase, approximately on day 21 of a 28-day cycle – Values range from 16 to 28 nmol/l as the lowest limit indicative of ovulation (NICE guidance) | 3 days |
| PROLACTIN | BLOOD  Lithium Heparin gel tube – 3.5ml | Male: 86-324 mu/l<br>Female: 102-496 mu/l<br><br>*Note: For Monoprolactin please see page 42* | 8 days |
| PROSTATIC SPECIFIC ANTIGEN (PSA) | BLOOD  Lithium Heparin gel tube – 3.5ml | In alignment with NICE NG12 for Red Flag referral (Prostate) patients:<br>• Refer as suspect cancer if the prostate feels malignant on digital rectal examination.<br>• Refer as suspect cancer on basis of a PSA result if the level is >20 µg /L<br>• Refer as a suspected cancer (for an appointment within 2 weeks) if PSA levels are above the referral range detailed below, at both initial testing and when repeated again at between 2-4 weeks later:<br><40y: Use clinical judgement<br>40-49y: >2.5 µg/L<br>50-59y: >3.5 µg/L<br>60-69y: >4.5 µg/L<br>70-79y: >6.5 µg/L<br>>79y: Use clinical judgement<br>See NICAN for further information. | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| PROTEIN | URINE<br> 24h collection of urine – no preservative<br> Random urine in yellow Sarstedt urine vacutainer | <0.14 g/24h | 1 day |
| PROTEIN/ CREATININE RATIO | URINE<br> Random urine in yellow Sarstedt urine vacutainer | <15 mg/mmol | 1 day |
| PROTEIN ELECTROPHORESIS<br>Total protein<br>Albumin<br><br>*Not UKAS accredited* | BLOOD<br>Adult:<br> Gel tube – 5ml<br>Paediatric:<br> Gel blood tube –400µl | 60-80 g/l (Also age related)<br>35-50 g/l (Also age related) | 5 working days |
| PTH (Parathyroid Hormone) | BLOOD<br> EDTA tube – 4ml | 17-74 pg/ml | 24 hours |
| PTH related Peptide (PTH rP) | BLOOD<br>Special tube – Contact Lab (Ext. 21522)<br>Send to Lab immediately | | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| Q-FIT<br>(Quantitative Faecal Immunochemical Test) | FAECES<br>Special test kit – Contact Lab (Ext. 21522)<br>*The test is available to a cohort of Gastroenterologists, Colorectal and General Surgeons only. If any clinician outside the cohort wants to request the test, they should do so through the patient's own GP or in exceptional circumstances only, their own consultant code.* | | R* |
| RENAL PROFILE<br>(PRE DIALYSIS)<br>Sodium<br>Potassium<br>Chloride<br>Urea<br>Creatinine<br><br>Bicarbonate<br><br>Albumin<br>ALP<br>Calcium<br>Calcium (adjusted)<br>eGFR<br>Phosphate<br>CRP<br>Iron<br>Transferrin<br>% Saturation<br><br>Ferritin | BLOOD<br> Lithium Heparin gel tube – 3.5ml | <br><br>135-146 mmol/l<br>3.5-4.6 mmol/l (Also age related)<br>95-108 mmol/L<br>2.5-7.8 mmol/l (Also age related)<br>Male: 59-104 umol/l (Also age related)<br>Female: 45-84 umol/l (Also age related)<br>22-29 mmol/L (Also age related)<br><br>35-50 g/l (Also age related)<br>30-130 U/l (Also age related)<br>2.2-2.6 mmol/l (Also age related)<br>2.2-2.6 mmol/l<br>≥60ml/min/1.73m$^2$<br>0.8-1.5 mmol/l (Also age related)<br>0 – 5<br>10-30 umol/l (Also age related)<br>2.0-3.6 g/l (Also age related)<br>Male: ≥16yrs old: 16-50%<br>Female: ≥16yrs old: 16-40%<br>Male: 30-400 ug/l<br>Female <55yrs old: 15-150 ug/l<br>Female >55yrs old: 15-330 ug/l | |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| RENAL PROFILE (POST DIALYSIS)<br><br>Potassium<br>Urea | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml | <br><br>3.5-4.6 mmol/l (Also age related)<br>2.5-7.8 mmol/l (Also age related) | |
| RENAL STONE | *See Test Protocols for information* | | 1 day / R* |
| RENIN ACTIVITY | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| RHEUMATOID FACTOR<br>*Note: Not available on samples from primary care. The Anti-CCP antibody test is more specific for rheumatoid arthritis and requires a yellow topped gel tube to be sent to the Regional Immunology Laboratory.* | BLOOD<br><br>Gel tube – 5ml | <14 IU/ml | 1 day |
| SALICYLATE | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml<br>***(>4hr post-overdose)*** | | 1 day |
| SELENIUM | See BHSCT Laboratory User Manual for specimen information<br>*(Contact Ext 21522 for trace metal blood tubes)* | See BHSCT Laboratory User Manual for reference interval information | R* |
| SEX HORMONE BINDING GLOBULIN (SHBG) | BLOOD<br><br>Lithium Heparin gel tube – 3.5ml | Male 20-49yrs: 16.5-55.9 nmol/L<br>Male ≥50yrs: 19.3 – 76.4 nmol/L<br><br>Female 20-49yrs: 24.6-122 nmol/L<br>Female ≥50yrs: 17.3 – 125 nmol/L | 5 days |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| SODIUM | URINE  24h collection of urine – no preservative | 40-220 mmol/24h | 1 day |
| SWEAT TEST | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| SYNACTHEN TEST | BLOOD  Lithium Heparin gel tube – 3.5ml | See Test Protocols for synacthen protocol | 1 day |
| TACROLIMUS | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| TEICOPLANIN | BLOOD  Lithium Heparin gel tube – 3.5ml | Trough: 20-50 mg/l | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| TESTOSTERONE | BLOOD<br> Lithium Heparin gel tube – 3.5ml | Male<br>20-49yrs: 8.6 – 29.0 nmol/L<br>≥50yrs: 6.7 – 25.7 nmol/L<br>Tanner Stage 1: <0.1 nmol/L<br>Tanner Stage 2: <15 nmol/L<br>Tanner Stage 3: 2.2 – 27.0 nmol/L<br>Tanner Stage 4: 6.2 – 26.5 nmol/L<br>Tanner Stage 5: 6.5 – 30.6 nmol/L<br><br>Female<br>20-49yrs: 0.3 – 1.7 nmol/L<br>≥50yrs: 0.1 – 1.4 nmol/L<br>Tanner Stage 1: <0.2 nmol/L<br>Tanner Stage 2: <0.4 nmol/L<br>Tanner Stage 3: <0.8 nmol/L<br>Tanner Stage 4: <0.9 nmol/L<br>Tanner Stage 5: 0.1 – 1.3 nmol/L | 5 days |
| THALLIUM | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| THEOPHYLLINE | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin Tube – 400µl | Oral:<br>Check 5 days after starting and >3 days after dose adjustment – sample time should be consistent (ideally trough levels or peak 4–6 hours post-dose)<br><br>Intravenous:<br>4–6 hours after starting treatment<br><br>Therapeutic range: 10-20 mg/L<br>Increased signs of toxicity: >20 mg/L | 28 hours |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| THYROID FUNCTION<br>Free T4<br>Thyroid Stimulating Hormone (TSH) | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin Tube – 400µl X 2 | 12-22 pmol/l (Also age related)<br><br>0.27-4.20 mU/l (Also age related) | 1 day |
| TOBRAMYCIN | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| TPMT | BLOOD  EDTA tube – 4ml | | R* |
| TRANSFERRIN | BLOOD<br> Lithium Heparin gel tube – 3.5ml | 2.0-3.6 g/l (Also age related) | 1 day |
| TREPONEMA PALLIDUM TOTAL ANTIBODY (SYPHILIS SCREEN) | See BHSCT Laboratory User Manual for specimen information *(Microbiology section)* | | R* |
| TROPONIN T HS | BLOOD<br> Lithium Heparin gel tube – 3.5ml | Male ≤17ng/L<br>Female ≤9ng/L | 1 day |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| URATE | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>URINE<br> 24h collection of urine – with 10% thymol preservative | Male: 202-417 umol/L<br>Female: 143 – 339 umol/L<br><br>1.5-4.5 mmol/24h | 1 day |
| VALPROATE | BLOOD<br> Lithium Heparin gel tube – 3.5ml | 50-100 mg/L | 28 hours |
| VANCOMYCIN | BLOOD<br>Adult:<br> Lithium Heparin gel tube – 3.5ml<br><br>Paediatric:<br> Lithium Heparin Tube – 400µl | Target trough range: 10-15mgmg/L<br>(For severe deep seated infections aim for range 15-20mg/L)<br>**Must be sent to the Laboratory on a Yellow Urgent Clinical Biochemistry Request Form**<br><br>Adjust dosing interval/dose according to levels. Contact Microbiology or antimicrobial pharmacist for advice if levels outside target range. | 1 day |
| VIT. A & VIT. E<br>Vitamin A<br>Vitamin E | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |

| TEST | SPECIMEN | REFERENCE INTERVAL | EXPECTED TURNAROUND TIME |
|---|---|---|---|
| VIT. B12 & FOLATE<br>Vitamin B12<br><br><br><br><br>Folate | BLOOD<br> Lithium Heparin gel tube – 3.5ml<br>Paediatric:<br> Lithium Heparin Tube – 400µl | Normal: >350ng/l<br>*<180ng/l =Confirmed B12 deficiency*<br>*180-350ng/l = Indeterminate test result, possible B12 deficiency*<br>*>350ng/l = Suggests vitamin B12 deficiency unlikely*<br><br>Normal: 3.0-26.8ug/l<br>*<3ug/l is indicative of folate deficiency (BSH 2014)* | 1 day |
| VITAMIN D-25 | See BHSCT Laboratory User Manual for specimen information | See BHSCT Laboratory User Manual for reference interval information | R* |
| VITAMIN D-1-25 | BLOOD<br> Clotted blood tube – 6ml | | R* |
| ZINC | See BHSCT Laboratory User Manual for specimen information<br>*(Contact Ext 21522 for trace metal blood tubes)* | See BHSCT Laboratory User Manual for reference interval information | R* |

**** R refers to tests that are sent to a Referral/Regional Laboratories for analysis***

## AGE RELATED REFERENCE INTERVALS

<table>
<tr><th>TEST</th><th>AGE</th><th>REFERENCE INTERVAL</th></tr>
<tr><td>AFP</td><td colspan="2">In utero, the AFP serum concentration increases until it reaches a peak at 14 weeks gestation and then decreases steadily. AFP synthesis almost ceases at parturition resulting in an exponential fall of AFP serum concentrations in the first year of life. The age-related reference range is shown below:<br><br>
<table>
<tr><th>Age</th><th>AFP Reference Range (kU/L)</th></tr>
<tr><td>Birth</td><td>50,000 – 150,000</td></tr>
<tr><td>2 weeks</td><td>7,000 – 20,000</td></tr>
<tr><td>4 weeks</td><td>1,500 – 2,500</td></tr>
<tr><td>6 weeks</td><td>200 - 400</td></tr>
<tr><td>8 weeks</td><td>50 - 100</td></tr>
<tr><td>10 weeks</td><td>6 - 12</td></tr>
<tr><td>3 months to 50 years</td><td>3 - 10</td></tr>
<tr><td>50 – 70 years</td><td>< 15</td></tr>
<tr><td>70 – 90 years</td><td>< 20</td></tr>
</table>
NOTE: Higher values are seen in the premature infant and the degree of immaturity will influence the age (from birth) at which basal levels are attained<br><br>
Reference: PRU handbook of Clinical Immunochemistry (9th Ed.)</td></tr>
<tr><td rowspan="6">Albumin</td><td>0 to < 15 days</td><td>33 - 45 g/L</td></tr>
<tr><td>15 days to < 1 yr</td><td>31 - 50 g/L</td></tr>
<tr><td>1 yr to < 8yr</td><td>40 - 49</td></tr>
<tr><td>8 yr to < 15 yr</td><td>42 - 51</td></tr>
<tr><td>15 yr to <19 yr (Female)</td><td>40 - 53</td></tr>
<tr><td>15 yr to <19 yr (Male)</td><td>43 - 53</td></tr>
<tr><td rowspan="6">Alkaline Phosphatase</td><td>0 to < 15 days</td><td>83 - 248 U/L</td></tr>
<tr><td>15 days to < 1 yr</td><td>122 - 469 U/L</td></tr>
<tr><td>1 yr to < 10 yr</td><td>142 – 335 U/L</td></tr>
<tr><td>10 yr to < 13 yr</td><td>129 – 417 U/L</td></tr>
<tr><td>13 yr to < 15 yr (Female)</td><td>57 – 254 U/L</td></tr>
<tr><td>13 yr to < 15 yr (Male)</td><td>116 – 468 U/L</td></tr>
</table>

| TEST | AGE | REFERENCE INTERVAL |
|---|---|---|
| | 15 yr to < 17 yr (Female) | 50 -117 U/L |
| | 15 yr to < 17 yr (Male) | 82 – 331 U/L |
| | 17 yr to < 19 yr (Female) | 45 – 87 U/L |
| | 17 yr to < 19 yr (Male) | 55 – 149 U/L |
| ALT | 0 to < 1yr | 0 – 25 U/L |
| | 1 yr to < 13 yr | 0 – 19 U/L |
| | 13 yr to < 19 yr | 0 – 17 U/L |
| | 13 yr to < 19 yr | 0 – 18 U/L |
| AST | 0 to < 15 days | 0 – 155 U/L |
| | 15 days to < 1 yr | 0 – 63 U/L |
| | 1 yr to < 7yr | 0 – 41 U/L |
| | 7 yr to < 12yr | 0 – 33 U/L |
| | 12 yr to < 19 yr (Female) | 0 – 23 U/L |
| | 12 yr to < 19 yr (Male) | 0 – 32 U/L |
| Ammonia | Sick/premature | <150 umol/L |
| | 0 – 28 days | <100 umol/L |
| | ≥29 days | <50 umol/L |
| Bicarbonate | 0 to <15 days | 10 – 20 mmol/L |
| | 15 days to < 1 yr | 10 – 24 mmol/L |
| | 1 yr to < 5yr | 14 – 24 mmol/L |
| | 5yr to <15 yr | 17 – 26 mmol/L |
| | 15 yr to <19 yr (Female) | 17 – 26 mmol/L |
| | 15 yr to <19 yr (Male) | 18 – 28 mmol/L |
| Calcium (inc. adjusted Calcium) | 0 to < 1yr | 2.16 - 2.74 mmol/L |
| | 1 to < 19 yr | 2.31 - 2.64 mmol/L |
| Cholesterol | 0 to <15 days (Female) | 1.3 – 3.2 mmol/L |
| | 0 to <15 days (Male) | 1.2 – 2.8 mmol/L |
| | 15 days to < 1yr | 1.7 – 6.1 mmol/L |
| | 1 yr to < 19 yr | 2.9 – 5.4 mmol/L |
| Creatinine | 0 to < 15 days | 35 - 86 umol/L |
| | 15 days to <2yr | 15 - 38 umol/L |
| | 2 to <5 yr | 24 - 43 umol/L |
| | 5 to <12 yr | 33 - 59 umol/L |
| | 12 to <15 yr | 45 - 77 umol/L |

| TEST | AGE | REFERENCE INTERVAL |
|---|---|---|
| | 15 to < 19 yr | 48 - 79 umol/L |
| Direct Bilirubin | 0 to < 15 days | 4 – 9 |
| | 15 days to < 1 yr | 0 – 4 |
| | 1 yr to < 9 yr | 0 – 2 |
| | 9 yr to < 13 yr | 0 – 4 |
| | 13 yr to < 19 yr (Female) | 0 – 5 |
| | 13 yr to < 19 yr (Male) | 1 – 5 |
| FT3 | 0 - 6 days | 2.7 - 9.7 pmol/L |
| | >6d to ≤3 mth | 3.0 - 9.3 pmol/L |
| | >3 mth to ≤12 mth | 3.3 – 9.0 pmol/L |
| | >1 yr to ≤6 yr | 3.7 - 8.5 pmol/L |
| | > 6 yr to ≤11 yr | 3.9 – 8.0 pmol/L |
| | >11yr to ≤20 yr | 3.9 - 7.7 pmol/L |
| FT4 | 0 - 6 days | 11.0 - 32.0 pmol/L |
| | >6d to ≤3 mth | 11.5 - 28.3 pmol/L |
| | >3 mth to ≤12 mth | 11.9 - 25.6 pmol/L |
| | >1 yr to ≤6 yr | 12.3 - 22.8 pmol/L |
| | > 6 yr to ≤11 yr | 12.5 - 21.5 pmol/L |
| | >11yr to ≤20 yr | 12.6 - 21.0 pmol/L |
| Ferritin | 0 to < 1 month | 150 - 973 ug/l |
| | 1 m to < 6 month | 8.5 - 580 ug/l |
| | 6 months to < 15 yr | 14 - 101 ug/l |
| | 15 yr to < 19 yr (Female) | 3.9 - 114 ug/l |
| | 15 yr to < 19 yr (Male) | 21 - 173 ug/l |
| GGT | 0 to < 15 days | 17 – 175 U/L |
| | 15 days to < 1yr | 5 -101 U/L |
| | 1 yr to < 11 yr | 4 – 12 U/L |
| | 11 yr to < 19 yr | 4 – 16 U/L |
| HDL Cholesterol | 0 to <15 days | 0.18 – 1.01 mmol/l |
| | 15 days to < 1yr | 0.0 – 1.95 mmol/l |
| | 1 yr to < 4 yr | 0.72 – 1.68 mmol/l |
| | 4 yr to < 13 yr | 0.81 – 1.99 mmol/l |
| | 13 yr to < 19 yr (Female) | 0.70 – 1.96 mmol/l |
| | 13 yr to < 19 yr (Male) | 0.69 – 1.85 mmol/l |
| IgA | 0 - 2 weeks old | 0.01 - 0.08 g/L |
| | 2 - 6 weeks old | 0.02 - 0.15 g/L |

| TEST | AGE | REFERENCE INTERVAL |
|---|---|---|
| | 6 - 12 weeks old | 0.05 - 0.40 g/L |
| | 3 - 6 months old | 0.10 - 0.50 g/L |
| | 6 - 9 months old | 0.15 - 0.70 g/L |
| | 9 - 12 months old | 0.20 - 0.70 g/L |
| | 1 - 2 yrs old | 0.30 - 1.20 g/L |
| | 2 - 3 yrs old | 0.30 - 1.30 g/L |
| | 3 - 6 yrs old | 0.40 - 2.00 g/L |
| | 6 - 9 yrs old | 0.50 - 2.40 g/L |
| | 9 - 12 yrs old | 0.70 - 2.50 g/L |
| | 12 - 45 yrs old | 0.80 - 2.80 g/L |
| | Over 45 yrs old | 0.80 - 4.00 g/L |
| IgG | 0 - 2 weeks old | 5.0 - 17.0 g/L |
| | 2 - 6 weeks old | 3.9 - 13.0 g/L |
| | 6 - 12 weeks old | 2.1 - 7.7 g/L |
| | 3 - 6 months old | 2.4 - 8.8 g/L |
| | 6 - 9 months old | 3.0 - 9.0 g/L |
| | 9 - 12 months old | 3.0 - 10.9 g/L |
| | 1 - 2 yrs old | 3.1 - 13.8 g/L |
| | 2 - 3 yrs old | 3.7 - 15.8 g/L |
| | 3 - 6 yrs old | 4.9 - 16.1 g/L |
| | 6 - 15 yrs old | 5.4 - 16.1 g/L |
| | Over 15 yrs old | 6.0 - 16.0 g/L |
| IgM | 0 - 2 weeks old | 0.05 - 0.20 g/L |
| | 2 - 6 weeks old | 0.08 - 0.40 g/L |
| | 6 - 12 weeks old | 0.15 - 0.70 g/L |
| | 3 - 6 months old | 0.20 - 1.00 g/L |
| | 6 - 9 months old | 0.40 - 1.60 g/L |
| | 9 - 12 months old | 0.60 - 2.10 g/L |
| | 1 - 3 yrs old | 0.50 - 2.20 g/L |
| | 3 - 6 yrs old | 0.50 - 2.00 g/L |
| | 6 - 12 yrs old | 0.50 - 1.80 g/L |
| | 12 - 45 yrs old | 0.50 - 1.90 g/L |
| | Over 45 yrs old | 0.50 - 2.00 g/L |
| Iron | 0 to < 14 yr | 5 – 25 umol/L |
| | 14 yr to < 19 yr (Female) | 6 – 30 umol/L |
| | 14 yr to < 19 yr (Male) | 8 – 31 umol/L |

<table>
<tr><th>TEST</th><th>AGE</th><th>REFERENCE INTERVAL</th></tr>
<tr><td rowspan="6">LDH</td><td>0 to <15days</td><td>0 – 1128 U/L</td></tr>
<tr><td>15days to 1yr</td><td>0 – 424 U/L</td></tr>
<tr><td>1yr to 10yrs</td><td>0 – 305 U/L</td></tr>
<tr><td>10yrs to 15yrs (Female)</td><td>0 – 260 U/L</td></tr>
<tr><td>10yrs to 15yrs (Male)</td><td>0 – 270 U/L</td></tr>
<tr><td>15yrs to <19yrs</td><td>0 – 240 U/L</td></tr>
<tr><td>Lithium</td><td>Elderly</td><td>0.4 - 0.8 mmol/L</td></tr>
<tr><td rowspan="3">Magnesium</td><td>0 to <15 days</td><td>0.82 – 1.62 mmol/L</td></tr>
<tr><td>15 days to < 1yr</td><td>0.81 - 1.27 mmol/L</td></tr>
<tr><td>1 to < 19 yr</td><td>0.86 – 1.17 mmol/L</td></tr>
<tr><td>NT pro BNP</td><td colspan="2">Age related ref range only - (Reference: Roche kit insert 2023-12 v.4)
<table>
<tr><th>Gender</th><th>Agreed regional age Interval (where applicable)</th><th>Lower (ng/L)</th><th>Upper (ng/L)</th></tr>
<tr><td>M/F</td><td><1yr</td><td></td><td>*</td></tr>
<tr><td>M/F</td><td>1yr to 3yrs</td><td></td><td><320</td></tr>
<tr><td>M/F</td><td>4yrs to 6yrs</td><td></td><td><190</td></tr>
<tr><td>M/F</td><td>7yrs to 9yrs</td><td></td><td><145</td></tr>
<tr><td>M/F</td><td>10yrs</td><td></td><td><112</td></tr>
<tr><td>M/F</td><td>11yrs</td><td></td><td><317</td></tr>
<tr><td>M/F</td><td>12yrs</td><td></td><td><186</td></tr>
<tr><td>M/F</td><td>13yrs</td><td></td><td><370</td></tr>
<tr><td>M/F</td><td>14yrs</td><td></td><td><363</td></tr>
<tr><td>M/F</td><td>15yrs</td><td></td><td><217</td></tr>
<tr><td>M/F</td><td>16yrs</td><td></td><td><206</td></tr>
<tr><td>M/F</td><td>17yrs</td><td></td><td><135</td></tr>
<tr><td>M/F</td><td>18yr</td><td></td><td><115</td></tr>
<tr><td>M/F</td><td>19yr to 34yrs</td><td></td><td><115</td></tr>
<tr><td>F</td><td>35yrs to 44yrs</td><td></td><td><237</td></tr>
<tr><td>M</td><td>35yrs to 44yrs</td><td></td><td><115</td></tr>
<tr><td>F</td><td>45yrs to 54yrs</td><td></td><td><284</td></tr>
<tr><td>M</td><td>45yrs to 54yrs</td><td></td><td><173</td></tr>
<tr><td>F</td><td>55yrs to 64yrs</td><td></td><td><352</td></tr>
<tr><td>M</td><td>55yrs to 64yrs</td><td></td><td><386</td></tr>
<tr><td>F</td><td>65yrs to 74yrs</td><td></td><td><623</td></tr>
<tr><td>M</td><td>65yrs to 74yrs</td><td></td><td><879</td></tr>
<tr><td>F</td><td>75yrs and over</td><td></td><td><1800</td></tr>
<tr><td>M</td><td>75yrs and over</td><td></td><td><1800</td></tr>
</table>
*no ref interval available/ quoted for <1yr old</td></tr>
<tr><td rowspan="6">Phosphate</td><td>0 to < 15 days</td><td>1.71 – 3.15 mmol/L</td></tr>
<tr><td>15 days to < 1yr</td><td>1.47 – 2.54 mmol/L</td></tr>
<tr><td>1 yr to < 5 yr</td><td>1.33 – 2.06 mmol/L</td></tr>
<tr><td>5 yr to < 13 yr</td><td>1.28 – 1.82 mmol/L</td></tr>
<tr><td>13 yr to < 16 yr (Female)</td><td>1.00 – 1.70 mmol/L</td></tr>
<tr><td>13 yr to < 16 yr (Male)</td><td>1.11 – 1.88 mmol/L</td></tr>
</table>

| TEST | AGE | REFERENCE INTERVAL |
|---|---|---|
| | 16 yr to < 19 yr | 0.94 – 1.55 mmol/L |
| Potassium (plasma) | 0 to < 1 w | 3.5 - 6.2 mmol/L |
| | 1 w to <26 w | 3.8 – 6.4 mmol/L |
| | 26 w to <2 yr | 3.5 – 5.4 mmol/L |
| | 2yr to < 18yr | 3.3 – 4.9 mmol/L |
| Total Bilirubin | 0 to < 15 days | 0 -250 umol/L |
| | 15 days to < 1 yr | 0 -10 umol/L |
| | 1 yr to < 9yr | 0 - 5 umol/L |
| | 9 yr to < 12 yr | 0 – 8 umol/L |
| | 12 yr to <15 yr | 0 – 10 umol/L |
| | 15 yr to <19 yr | 0 – 12 umol/L |
| Total Protein | 0 to <15 days | 51 – 80 g/L |
| | 15 days to < 1yr | 43 – 69 g/L |
| | 1 yr to < 6 yr | 59 – 73 g/L |
| | 6 yr to < 9 yr | 62 – 75 g/L |
| | 9 yr to <19 yr | 63 – 78 g/L |
| Transferrin | 0 to < 9 weeks | 1.11 – 2.43 g/L |
| | 9 weeks to < 1 yr | 1.15 – 3.52 g/L |
| | 1 yr to < 19 yr | 2.38 – 3.66 g/L |
| Transferrin Saturation | 0 to < 1yr | 4.1 – 59 % |
| | 1 yr to < 14 yr | 6.5 – 39 % |
| | 14 yr to < 16 yr (Female) | 5.2 – 44 % |
| | 14 yr to < 16 yr (Male) | 9.6 – 58 % |
| Triglycerides | 0 to <15 days | 1.02 – 3.25 mmol/L |
| | 15 days to < 1yr | 0.65 – 3.24 mmol/L |
| | 1 yr to < 19 yr | 0.54 – 2.47 mmol/L |
| TSH | 0 - 6 days | 0.70 - 15.20 mu/L |
| | >6d to ≤3 mth | 0.72 - 11.00 mu/L |
| | >3 mth to ≤12 mth | 0.73 - 8.35 mu/L |
| | >1 yr to ≤6 yr | 0.70 - 5.97 mu/L |
| | >6 yr to ≤11 yr | 0.60 - 4.84 mu/L |
| | >11 yr to ≤20 yr | 0.51 - 4.30 mu/L |
| Urea | 0 to < 15 days | 1.1 – 7.9 mmol/L |
| | 15 days to <1 yr | 1.3- 5.8 mmol/L |
| | 1 yr to < 10 yr | 3.2 – 7.6 mmol/L |
| | 10 yr to <19 yr (Female) | 2.6 – 6.5 mmol/L |

| TEST | AGE | REFERENCE INTERVAL |
|---|---|---|
| | 10 yr to <19 yr (Male) | 2.6 – 7.2 mmol/L |
| Urine Calcium / Creatinine Ratio | <12mths | <2.0 mmol/mmol CR |
| | 1-3yrs | <1.5 mmol/mmol CR |
| | 3-5yrs | <1.1 mmol/mmol CR |
| | 5-7yrs | <0.8 mmol/mmol CR |
| | >7yrs | <0.6 mmol/mmol CR |
| Urine Magnesium / Creatinine Ratio | 6-12mths | 0.4 -2.2 mmol/mmol CR |
| | 1-2yrs | 0.4 -1.7 mmol/mmol CR |
| | 2-3yrs | 0.3 -1.6 mmol/mmol CR |
| | 3-5yrs | 0.3 -1.3 mmol/mmol CR |
| | 5-7yrs | 0.3 -1.0 mmol/mmol CR |
| | 7-10yrs | 0.3 -0.9 mmol/mmol CR |
| | 10-14yrs | 0.2 -0.7 mmol/mmol CR |
| | 14-17yrs | 0.2 -0.6 mmol/mmol CR |
| Urine Phosphate / Creatinine Ratio | 6-12mths | 1.2 -19 mmol/mmol CR |
| | 1-2yrs | 1.2 -14 mmol/mmol CR |
| | 2-3yrs | 1.2 -12 mmol/mmol CR |
| | 3-5yrs | 1.2 -8.0 mmol/mmol CR |
| | 5-7yrs | 1.2 -5.0 mmol/mmol CR |
| | 7-10yrs | 1.2 -3.6 mmol/mmol CR |
| | 10-14yrs | 0.8 -3.2 mmol/mmol CR |
| | 14-17yrs | 0.8 -2.7 mmol/mmol CR |

## PREGNANCY RELATED REFERENCE INTERVALS

| TEST | |
|---|---|
| AFP | AFP is detectable in maternal serum and in amniotic fluid during pregnancy. AFP concentrations peak around 30 weeks gestation and fall to normal non-pregnant concentrations at delivery. Reference ranges for meternal serum at different getational ages (in weeks) are shown below: |

| | | AFP Reference Range (kU/L) | | |
|---|---|---|---|---|
| | Weeks gestation | 10th centile | 50th centile (Median) | 95th centile |
| Maternal Serum | 14 | < 10 | 19 | 50 |
| | 15 | < 10 | 24 | 60 |
| | 16 | 10 | 31 | 69 |
| | 17 | 11 | 37 | 81 |
| | 18 | 13 | 43 | 98 |
| | 19 | 15 | 50 | 115 |
| | 20 | 18 | 60 | 123 |
| | 21 | 21 | 67 | 142 |

*References:*

*Protein Reference Units – Handbook of Clinical Immunochemistry 9th Edition (2007)*

*AFP Kit Insert – Roche Cobas Modular Analytics (2021)*

| TEST | AGE | REFERENCE INTERVAL |
|---|---|---|
| FT3 | Trimester I | 3.8 - 6.0 pmol/L |
| | Trimester II | 3.2 - 5.5 pmol/L |
| | Trimester III | 3.1 - 5.0 pmol/L |
| FT4 | Trimester I | 12.1 - 19.6 pmol/L |
| | Trimester II | 9.6 - 17.0 pmol/L |
| | Trimester III | 8.4 - 15.6 pmol/L |
| HCG *(Age relates to gestation weeks)* | 3 wks | 5.8 - 71.2 U/L |
| | 4 wks | 9.5 - 750 U/L |
| | 5 wks | 217 - 7138 U/L |
| | 6 wks | 158 - 31795 U/L |
| | 7 wks | 3697- 163563 U/L |
| | 8 wks | 32065 - 149571 U/L |
| | 9 wks | 63803 - 151410 U/L |
| | 10 wks | 46509 - 186977 U/L |
| | 12 wks | 27832 - 210612 U/L |
| | 14 wks | 13950 - 62530 U/L |
| | 15 wks | 12039 - 70971 U/L |
| | 16wks | 9040 - 56451 U/L |
| | 17 wks | 8175 - 55868 U/L |
| | 18 wks | 8099 - 58176 U/L |

<table>
<tr><th>TEST</th><th>AGE</th><th>REFERENCE INTERVAL</th></tr>
<tr><td>LIVER FUNCTION TESTS<br>(LFT)<br>ALT<br>GGT<br>AST<br>ALP<br>Total Bilirubin</td><td colspan="2">The following trimester-specific reference ranges are recommended for use in normal pregnancy when reviewing results of liver function tests.<br><table><tr><th></th><th>Non-pregnant</th><th>1st Trimester</th><th>2nd Trimester</th><th>3rdTrimester</th></tr><tr><td>ALT U/L</td><td>0 - 34</td><td>3 - 30</td><td>2 - 33</td><td>2 - 25</td></tr><tr><td>GGT U/L</td><td>0 – 38</td><td>2 – 23</td><td>4 – 22</td><td>3 – 26</td></tr><tr><td>AST U/L</td><td>0 - 31</td><td>3 – 23</td><td>3 – 33</td><td>4 – 32</td></tr><tr><td>ALP U/L</td><td>30 – 130</td><td>17 – 88</td><td>25 – 126</td><td>38 – 229</td></tr><tr><td>Total bilirubin umol/L</td><td>< 21</td><td>1.7 – 6.8</td><td>1.7 – 13.7</td><td>1.7 – 18.8</td></tr></table></td></tr>
<tr><td rowspan="3">TSH</td><td>Trimester I</td><td>0.33 – 4.59 mU/L</td></tr>
<tr><td>Trimester II</td><td>0.35 – 4.10 mU/L</td></tr>
<tr><td>Trimester III</td><td>0.21 – 3.15 mU/L</td></tr>
</table>

## OTHER RELATED REFERENCE INTERVALS

| TEST | RELATED AREA | REFERENCE INTERVAL |
|---|---|---|
| AFP | AFP concentrations are elevated on 70-95% of patients with primary hepatocellular carcinoma and in patients with non-seminomatous germ cell tumours (NSGCT). | 0 – 10 kU/L<br><br>*References:*<br>*Protein Reference Units – Handbook of Clinical Immunochemistry 9th Edition (2007)*<br>*AFP Kit Insert – Roche Cobas Modular Analytics (2021)* |
| FT3 | Dialysis | 2.37 - 6.30 pmol/L |
| | Non thyroidal illness | 1.26 - 6.26 pmol/L |

## COMMON SPECIMEN ARTEFACTS

| PROBLEM | COMMON CAUSES | CONSEQUENCES |
|---|---|---|
| Contamination by infused fluids | High MW dextrans<br>Dextrose<br>Crystalloid solutions | Elevated total proteins<br>High glucose<br>Spurious $Na^+$, $K^+$, $Cl^-$, etc.<br>Low calcium<br>High $Na^+$ |
| Erroneous results | Drug interferences on analytical or physiological results | High or low results |
| Haemolysis | Expelling blood specimen through a needle into container<br>Over vigorous mixing of specimen | High $K^+$<br>High phosphate |

| PROBLEM | COMMON CAUSES | CONSEQUENCES |
|---|---|---|
| | Specimen stored in deep freeze<br>Excessive delay in transit<br>Specimen left in hot place | Low $Na^+$ and $Cl^-$<br>High AST and LD<br>High $Mg^{2+}$ |
| Incorrect container/ anticoagulant | No enzyme inhibitor<br>EDTA tube<br>Excess liquid heparin | Low glucose and ethanol<br>High $K^+$<br>Low calcium<br>Abnormal analytes |
| Lipaemia | Taken before intra-lipid is cleared<br>Taken after fatty meals<br>Anxiety and stress | Interferes with many assays because of turbidity of specimen. May cause low sodium concentration |
| Serum or plasma separation delay | Overnight storage<br>Delay in transit | High $K^+$, AST, LD, $Mg^{2+}$<br>Low $Na^+$ (occasionally) |

# TEST PROTOCOLS

The Laboratory has protocols for patient investigation available. These protocols can be seen on the following pages.

## 1. 24 Hour Collection of Urine

The bladder should be emptied at the start of the collection (conveniently 8am), whether or not the patient feels the need, and this urine discarded.

Note the start time (i.e. exact time the bladder was emptied) on the bottle label.

Collect all urine passed for the next 24 hours.

If you have a bowel movement please try and pass urine first so that none of the sample is lost.

Exactly 24 hours later the bladder should be emptied completely, whether or not the patient feels the need. Add this final specimen to complete the 24 hour collection.

Note the end time (i.e. when bladder emptied) on the bottle label. Also check the lid is secure and the container is leak free.

Send the completed collection and request form (securely attached to the container), with the times and date clearly noted, to the Laboratory without delay.

## 2. Anaphylactic Reactions

During routine hours anaphylaxis packs are available upon request from Specimen Reception (Ext. 21522). Out-of-hours contact the out-of-hours Biochemistry BMS (07872048346 or 63634) to request a pack. The packs consist of the RVH Immunology Laboratory request form, which details the procedure for the investigation and **must be filled in completely** to include times and dates of reaction and patient's medical history, etc, and the blood collection bottles required. Completed packs should be sent to the Ulster Hospital Laboratory Specimen Reception for forwarding to the RVH, Immunology.

## 3. Dexamethasone Suppression Test

These tests should be preceded by urinary free cortisol and baseline 08.00 and 23.00h plasma cortisol estimations if Cushing's Disease is seriously suspected.

<u>Overnight Low Dose Test</u>
Dexamethasone (1mg) is given orally at 23.00h-24.00h. Plasma cortisol is sampled between 08.00h-09.00h the following morning. A plasma cortisol of 50 nmol/l or less excludes Cushing's syndrome.

<u>High Dose Test</u>
Dexamethasone (2mg) is given orally every 6 hours starting 08.00h. Plasma cortisol is sampled at 08/00h and at 48 hours after starting the dexamethasone. Adequate suppression is usually defined as a plasma cortisol <50% of previously measured basal level. This test can be performed immediately following the low dose test.

## 4. Faecal Elastase

Faecal elastase has been shown to discriminate between diarrhoea of pancreatic and non-pancreatic origin. A single, formed, walnut sized random stool specimen (taken in fecon container) is required. Specimens will be forwarded to RVH Children's Lab, Kelvin building in the normal transport runs.

## 5. Gilberts Syndrome

Ensure patient is not taking drugs that will affect bilirubin metabolism. Obtain a 400 calorie diet sheet from a dietician. Collect blood specimens between 9am and 10.30am on three successive days for the following:

Day 1 – normal diet – Full blood count, blood firm,
liver function tests, direct bilirubin haptoglobin.
Day 2 – 400 calorie diet – Total and direct bilirubin.
Day 3 – 400 calorie diet – Total and direct bilirubin.

Interpretation: Unconjugated bilirubin (total – direct) usually rises by more than 90% within 48 hours in patients with Gilbert's syndrome, on a restricted diet. In patients with liver disease or haemolytic anaemia the rise is usually less than 50%.

## 6. Glucose Tolerance Test (GTT)

The GTT should be performed in cases where random or fasting plasma glucose measurements are unable to categorise an individual. The test should be administered in the morning after an overnight fast of between 10 hours and 16 hours, during which only water may be drunk. For at least three days prior to the test, the patient should have had a normal unrestricted diet containing at least 150g of carbohydrate and should have been normally physically active. Any recent infections or current medication should be noted. Ideally any medication known to influence blood glucose should be discontinued, if possible, for a period equivalent to five times the effective half-life of the drug. Smoking should be discouraged at all stages, but should be prohibited on the morning of the test.

During the test, the patient should be encouraged to sit quietly. A fasting blood specimen, Fluoride EDTA tube, should be collected and an adult patient given a solution of 75g of glucose to drink in a volume of approximately 300ml over 5 minutes. Current WHO opinion is that this should be 75g of anhydrous glucose or 82/5g of monohydrate. The test load for a child should be 1.75g per kg up to a maximum total of 75g of glucose. Equivalent solutions of partial hydrolysates of starch in similar volumes are also considered acceptable.

A further blood specimen is collected at 2 hours. Blood specimens are spun and plasma glucose is analysed by the Laboratory as soon as possible.

*Strip testing methods must not be used for diagnostic glucose measurements.*
*Urine collected at start and at 2 hours and checked on wards.*

<u>Interpretation</u>
For diagnosis of diabetes (in the non-pregnant state) either:

1. Symptoms plus random plasma glucose >11.1 mmol/l
2. Fasting plasma glucose >7.0 mmol/l
3. 2 hour plasma glucose after GGT >11.1 mmol/l
   - Glucose concentrations should be confirmed on a separate occasion in asymptomatic people
   - GTT is not recommended for routine testing
   - Fasting plasma glucose in the 6.1 - 6.9 mmol/l range is indicative of impaired fasting glucose. If resources allow, such individuals should go to a GTT.

International Association of Diabetes and Pregnancy Study Group (IADPSG) values for the diagnosis of Gestational Diabetes for the 75g OGTT:

| | |
|---|---|
| Fasting | ≥ 5.1 mmol/L |
| 1hr | ≥ 10.0 mmol/L |
| 2hr | ≥ 8.5 mmol/L |

*At least one threshold to be equalled or exceeded

## 7. Growth Hormone Excess

Follow the protocol for Glucose Tolerance Test as above. In addition to specimens for blood glucose, take specimens for Growth Hormone in yellow topped gel tubes at the stated times. Urine specimens are not required.

## 8. Growth Hormone Deficiency

Take a 2ml basal specimen in a yellow topped gel tube for growth hormone. Ask patient to exercise for 30 minutes. Take another specimen for growth hormone.

## 9. 5 Hydroxyindole Acetic Acid (5-HIAA)

Specimen Collection and Patient Preparation:
24hr urine using plain plastic container – no preservative.
Instruct the patient to void urine at 8.00am and discard the specimen. Then collect all urine for 24 hours, including the final specimen voided (i.e. 8.00am the next morning). Screw the lid on to the container securely, label the container with patient's details and the date and time. Send specimen to lab accompanied by appropriately completed form.

Interference:
The following foods are rich in 5-Hydroxyteyptamine (5-HT) and increase substantially the urinary output of 5-HIAA and should not be eaten for 3 days before urine collection:
*Pineapples, tomatoes, plums, walnuts, bananas, chocolate, kiwi fruit, and avocados*
The following drug preparations may also affect results:
*Imipramine, isoniazid, isocarboxazid, methyldopa, levadopa, MOA inhibitors*

## 10. Hypoglycaemic Admissions

During routine hours please phone Specimen Reception (Ext 21522) to request a hypopack. Out-of-hours contact the out-of-hours Biochemistry BMS (07872048346 or 63634). Some wards in the hospital have a hypopack stored permanently on the ward for immediate use. These wards are:

- A/E
- Jaffe Rapid Response
- Maynard Sinclair
- Special Care Baby Unit

The above packs are maintained and checked on a monthly basis by laboratory staff. The pack contains appropriately labelled specimen tubes and forms for your convenience. There is also a large double sided form from the Belfast Link Labs explaining the protocol to follow and the request form. Specimens should be forwarded to the laboratory as soon as possible for processing. Specimens received in the laboratory will be sent to the Regional Paediatric Laboratory, Clinical Chemistry, Kelvin Building, Royal Hospitals, Belfast Link labs on 10.30 am run.

## 11. Renal Stone Clinic

At the first consultation:

- Send a plasma sample to Biochemistry for bone profile, electrolyte profile & urate (gel tube)
- Send one MSSU sample to Microbiology for O&S
- Send a fresh urine sample (random, universal container) with no preservatives to Biochemistry for pH and cysteine, which will be processed by RVH Biochemistry

At the end of the consultation each patient should receive two 24h urine bottle with thymol preservative. The patient should be advised that the urine collection bottle contains thymol and

should be handled with care. The thymol bottle will be provided by the Ulster Hospital Biochemistry Laboratory and is available from Specimen Reception. The request form, as well as collection bottle, should be labelled for **renal stone profile 2**. When requesting Renal Stone Profile 2 the following tests will be completed alongside calculated output over 24 hours: Protein, Sodium, Creatinine, Urea, Calcium, Phosphate, Oxalate, Citrate and Urate. No individual tests can be requested without full profile being analysed. Return this to the Ulster Hospital Biochemistry Laboratory for forwarding on to RVH Biochemistry. **Urine should be kept at room temperature at all times.**

Two urine samples should be collected on at least two separate occasion of at least one week interval and sent to biochemistry laboratory. Urine can be stored at room temperature (preferable) or refrigerated at 4$^{o}$C. Please state storage conditions on request form.

24hr urine samples must have a sample date on the form (the date collection was started).

When 24 hour urine samples for renal stone profiles are taken less than one week apart, the second sample will be rejected.

## 12. Renin and Aldosterone Suppression Test

Mineralocorticoid Excess

Patient Preparation and Procedure: Specimens must be taken under rigidly controlled conditions if results are to be meaningful.

1. All hypertensive drugs should be discontinued for 2 weeks prior to testing, if possible, and the patient should be on an adequate intake of sodium (100-150 mmol/day) and potassium (50-100 mmol/day).
2. Administer potassium to restore plasma levels to the reference interval or as near as possible. Discontinue supplementation 24hr before blood specimens are taken.
3. Patient must be admitted to ensure **strict** overnight recumbency.
4. After waking , the patient **must** remain lying down and not alter posture in any way until after the initial blood specimens have been taken as follows:

Blood Specimens Required

| | |
|---|---|
| 08.00 (before breakfast) | Purple topped EDTA specimen (must be filled to 4ml line) for both **Aldosterone** and **Renin** |

Allow patient to rise and keep ambulatory for 2 hours

| | |
|---|---|
| 10.00 (ambulatory) | Repeat the sampling for **Aldosterone** and **Renin** |

***Please inform Lab (Ext 21522) when sending specimens.***

Mineralocorticoid Deficiency

Patient Preparation and Procedure: After waking, the patient **must** remain lying down and not alter posture in any way until after the initial blood specimens have been taken as follows:

| | |
|---|---|
| 08.00 (before breakfast) | Purple topped EDTA specimen (must be filled to 4ml line) for both **Aldosterone** and **Renin** |

Allow patient to rise, take breakfast and keep ambulatory for 2 hours

| | |
|---|---|
| 10.00 (ambulatory) | Repeat the sampling for **Aldosterone** and **Renin** |

***Please inform Lab (Ext 21522) when sending specimens.***

| Reference Intervals | **Renin:** | |
|---|---|---|
| | Upright posture (after standing for 30 minutes) | 4.4 – 46.1 µIU/ml |
| | Supine posture (after lying supine for 30 minutes) | 2.8 – 39.9 µIU/ml |
| | **Aldosterone:** | |
| | Upright posture (after standing for 30 minutes) | 61.2-977.8 pmol/L |
| | Supine posture (after lying supine for 30 minutes) | 32.4-653.7 pmol/L |

## 13. Saline Suppression Test

This can follow on from the above sampling procedure:

| | |
|---|---|
| 10.00 | Begin an infusion of saline (2L of 0.9%) over 4 hours. |
| 12.00 | Take blood specimen as previously for **Aldosterone** |
| 14.00 | Take blood specimen as previously for **Aldosterone** |

| Reference Intervals | | | |
|---|---|---|---|
| | Serum Aldosterone | supine | <400 pmol/L |
| | | ambulatory | <820 pmol/L |
| | Plasma Renin Activity | supine | <3.2 ng/mL/h |
| | | ambulatory | 1.8 - 6.7 ng/mL/h |

## 14. Rhabdomyolysis and Myoglobinuria

Specimen Type: 1 green top (li hep) gel tube requesting CK

Myoglobinuria lacks sensitivity as a test for rhabdomyolysis; it may be absent in 25-50% of patients with rhabdomyolysis due to the more rapid clearance of myoglobin, compared with CK, following muscle injury. Rhabdomyolysis may be diagnosed in a patient with either an acute neuromuscular illness or dark urine without other symptoms, plus a marked acute elevation in plasma creatine kinase (CK). **The CK is typically at least five times the upper limit of normal, and is usually greater than 5000 U/L.** No absolute cut-off value for CK elevation can be defined, and the CK should be considered in the clinical context of the history and examination findings.

## 15. Synacthen Test – The 30 minute Synacthen Test

Procedure: The patient should rest quietly but need not be in bed. Take a baseline specimen for cortisol estimation. Give 0.25 mg Synacthen IM. Take a further specimen at 30 minutes.

Interpretation: Normal response: Basal >120nmol/L
30mins >450nmol/L

1. Adrenal insufficiency is excluded by a 30 min value > 450 nmol/L (Roche method). The incremental rise or 60 minute value does not provide additional useful information.
2. An abnormal result should prompt referral to an endocrinologist.
3. Interpretation of basal and stimulated cortisol in the ICU setting is controversial.
4. If the patient is taking steroids discuss with the laboratory or an endocrinologist before the synacthen test is performed.
5. In ACTH deficiency the response to the short test may be normal or reduced. Care should be taken when interpreting synacthen tests in pituitary disease.
6. Baseline and incremental cortisol values do NOT apply to women taking oral contraceptives or to pregnant women. Omit oestrogen replacement for

6 weeks prior to the test (as increased CBG will make cortisol results difficult to interpret) and discuss with an endocrinologist.

## 16. Short Synacthen Test For Children

When booking the child, inform biochemistry of the date/time (Child does NOT need fasted). Inform biochemistry that the child is in and test is about to begin (ACTH is unstable and lab need to be ready for it). Put 4ml of ACTH into a cold EDTA tube (put it in ice before taking blood) and then bring specimen urgently to Biochemistry for spinning/freezing. Collect a specimen for cortisol at 30 (T30) and 60 (T60) minutes through the cannula, flushing with saline.

## 17. Trace Metal Specimen Containers

See BHSCT Laboratory User Manual for specimen information

## 18. Water Deprivation Test (Adults)

*NOTE: Laboratory must be informed in advance of commencing this test*

Preparation Up to 8.30hrs

- No tobacco/ alcohol for at least 24 hrs before the test
- Stop interfering medication (e.g. DDAVP and diuretics) but not hormone replacement
- Give a light breakfast (do not fast or limit fluids overnight)

Method

*Stage 1: Exclusion of Primary Polydipsia: 8.30 – 16.30 hrs*

1. No fluid allowed but dry food permitted, e.g. toast.
2. Weigh patient at time 0 and hourly intervals, stop test if >3% weight loss (positive result)
3. Urine passed and discarded at time 0, urine then passed hourly and hourly volume estimated
4. Urine specimen taken for osmolality from the total hourly collection on 4 occasions during procedure.

U1: 8.30 – 9.30 hrs
U2: 11.30 – 12.30 hrs
U3: 14.30 – 15.30 hrs
U4: 15.30 – 16.30 hrs

5. Blood taken for Osmolality at: S1: 9.00 hrs
S2: 12.00 hrs
S3: 15.00 hrs
S4: 16.00 hrs

6. Note down urine volumes at: U1: 9.30 hrs
U2: 12.30 hrs
U3: 15.30 hrs
U4 16.30 hrs

*Stage 2: Differential Diagnosis of Cranial Diabetes Insipidus from Nephrogenic Diabetes Insipidus: 16.30 – 20.30 hrs*

7. Patient may now eat and drink freely
8. At 16.30 hrs administer DDAVP: 20 mcg intra-nasally or 2 mcg i.m.
9. Continue to measure hourly urine volumes and take specimens for urine osmolality from these. Blood specimens for osmolality are not required as the only purpose now is to see the effects of the DDAVP on urine volume and osmolality.
10. Note down urine volumes at: U5: 17:30 hrs

U6: 18:30 hrs
U7: 19:30 hrs
U8: 20:30 hrs

Therapeutic Trial of DDAVP

Method

1. Admit to hospital
2. Monitor daily: fluid input and output, bodyweight, U&E, blood test and urine osmolality
3. Patient observed for 2 days and then 10mcg DDAVP given intranasally for at least 2-3 days.

## 19. Water Deprivation Test (Children)

Do not proceed with the test if the patient is already dehydrated. Check early morning urine osmolality if > 750 mosm/kg, test unnecessary. Weigh the patient at the start of the test and hourly.

Urine Specimens

Collect all urine passed after starting water deprivation test – record time and volume of these specimens. Send urine for osmolality at the following times:

| | |
|---|---|
| U1 | 0-1 hour |
| U2 | 3-4 hours |
| U3 | 6-7 hours |
| U4 | 7-8 hours |

Send urine in plain white top biochemistry urine bottles.

Blood Specimens

Send specimens in green top biochemistry paediatric tubes for *plasma osmolality* and *U&E* at the following times after commencing the test:

Blood 1 at 30 minutes
Blood 2 at 3½ hours
Blood 3 at 6½ hours
Blood 4 at 7½ hours

*NOTE: Stop the test if:*

- *Weight loss > 4kg or > 3% of body weight, proceed to vasopressin test*
- *Urinary osmolality > 800 mOsm/kg, test unnecessary no need to proceed to vasopressin test.*
- *After 8 hours if test still proceeding*

## 20. Vasopressin Test

This is carried out if water deprivation test is abnormal, e.g. urinary osmolality <600 mOsm/kg.

- Give aqueous vasopressin (Pitressin) 1u/m² subcutaneous.
- Allow patient to eat and drink.
- Repeat plasma U&E and osmolality and urine osmolality hourly for 4 hours.
- In diabetes insipidus plasma osmolality rises >300mOsm/kg and urine remains <270 mOsm/kg.

## GUIDANCE

The Laboratory has guidance for patient investigation available. This guidance can be seen on the following pages.

### 1. Treatment of Hypokalaemia in Adults

Intravenous treatment of hypokalaemia is necessary only if adequate intake of oral potassium supplements is not possible or if the clinical situation requires more rapid correction of hypokalaemia (e.g. hypokalaemic cardiac arrhythmias).

N.B. Intravenous treatment is usually required if plasma potassium < 2.5 mmol/l

Oral Therapy for Hypokalaemia

40-80 mmol potassium per day (patients with normal renal function - lower doses should be used in patients with renal insufficiency, common in the elderly).
Plasma potassium should be monitored regularly while on supplements.
When mild hypokalaemia is secondary to diuretics, consider use of potassium sparing diuretics.

Preparations available:

- Sando-K 12 mmol potassium/tablet
- Slow-K 8 mmol potassium/tablet (Less preferred - risk of oesophageal ulceration)
- Kay-Cee-L 1mmol potassium/1ml liquid

Intravenous Therapy

Prescriptions for intravenous potassium must

- Be expressed in millimoles of potassium
- Specify rate of infusion
- Make use of readymade potassium infusions wherever possible

Maximum concentration for peripheral administration is 40mmol potassium/1000ml.

Higher concentrations (80 mmol potassium/1000ml) may be administered to fluid restricted patients on the advice of a senior clinician. (There is an increased risk of pain or phlebitis at the infusion site. Must infuse via a central line).

Maximum rate of infusion in adults without ECG monitoring is 20 mmol potassium/hour.

Potassium infusions must always be administered via a rate controlled infusion device.

Plasma potassium levels should be checked 12 hourly until plasma potassium > 3.5 mmol/l and oral replacement continued until the metabolic alkalosis returns to normal. If the plasma potassium level fails to rise after 12-24 hours, check plasma magnesium levels.

| **Plasma potassium level** | **Adult patients with normal renal function & no fluid restriction** |
|---|---|
| Hypokalaemia (2.6-3.4mmol/l) | 40mmol in 1000ml sodium chloride 0.9% / glucose 5% over 8-12hrs |
| Severe hypokalaemia (< 2.5mmol/l) | 40mmol in 1000ml sodium chloride 0.9% / glucose 5% over 6-8 hrs |

NB Sodium chloride 0.9% is the preferred diluent since glucose solutions can cause hyperglycaemia and be associated with a shift of potassium into cells

The availability of ready to use potassium infusions can be found on iConnect.

High Strength potassium amps are subject to controlled drug requirements. Outside of authorised areas it must be ordered as per Policy relating to the management of potassium

## 2. Treatment of Hypomagnesaemia in Adults

Specific guidelines may exist for the use of magnesium in certain circumstances such as obstetrics, please seek advice.

Low plasma levels of magnesium have been noted in up to 10% of hospitalised patients particularly in the following situations:

1. Malnutrition & malabsorption
2. Chronic diarrhoea/ excess stoma loss/ vomiting/ NG aspiration
3. Renal tubular disorders
4. Alcohol excess/dependence
5. Patients prescribed certain drugs particularly chemotherapeutic agents e.g. cisplatin, also loop diuretics/ aminoglycosides/ proton pump inhibitors

Magnesium has several significant biological roles:

- It is a cofactor in many metabolic pathways including respiration, glycolysis and Na/ K ATPase reactions
- It is important in the maintenance of cell membrane electrical properties
- It is necessary for the secretion and action of parathyroid hormone

Magnesium Replacement – Key Principles

- Most of the body's magnesium stores are intracellular, principally within bone. Whilst plasma magnesium levels usually rise quickly with therapy, intracellular stores take longer to replete. It is therefore advisable in patients with normal renal function to continue magnesium repletion for at least one to two days after the plasma magnesium concentration normalizes.

- Like calcium, in the extracellular fluid magnesium can be ionized (free), bound to anions, or bound to protein. Apparent hypomagnesaemia will complicate hypoalbuminaemic states. There is no reliable calculation to correct for albumin levels but caution is advised when interpreting magnesium levels in severely hypoalbuminaemic states (plasma albumin <25 g/l).

- Plasma magnesium concentrations are regulated solely by renal excretion. Intravenous doses in particular can result in hypermagnesaemia when GFR is severely impaired (eGFR<30ml/min/1.73m2) and close post infusion magnesium monitoring is warranted.

Symptoms of Hypomagnesaemia

Symptoms of magnesium depletion are non-specific and are often unrecognised. Mild hypomagnesaemia (0.5-0.7 mmol/l) does not generally give rise to problems in the short-term. However chronic suboptimal plasma magnesium levels may predispose to dysrhythmias in cardiovascular disease; this is particularly important in patients on chronic diuretic therapy who may have co-existing hypokalaemia. Correction of magnesium deficiency is necessary in order to correct hypokalaemia. Magnesium deficiency must also be corrected (and looked for) in hypocalcaemic patients. Muscle weakness, cramp, carpopedal spasm or seizures may accompany hypomagnesaemia with or without hypocalcaemia. Mental changes and cerebellar signs may be associated with more severe magnesium depletion.

Treatment

A) Mild hypomagnesaemia (0.5-0.7 mmol/l) or prophylactic treatment

Oral magnesium is poorly absorbed and larger doses are poorly tolerated due to GI side effects. Prophylactic low dose oral therapy may be indicated in at risk subjects e.g. patients with refractory hypokalaemia on diuretics particularly if there is concurrent IHD. A total of 20-24 mmol magnesium daily in divided doses is recommended. The following oral magnesium products are available from pharmacy:

- Magnesium aspartate 6.5 g sachets (10 mmol Mg2+ per sachet) - one sachet twice a day
- Magnesium glycerophosphate tablets (4 mmol Mg2+ per tablet) – two tablets three times a day. This is an unlicensed preparation and should only be used for patients unable to tolerate magnesium aspartate sachets.

If intolerant of oral treatment and patient is symptomatic, consider intravenous infusion of 2 g (8 mmol) magnesium (4 ml magnesium sulphate 50% injection) in 100ml sodium chloride 0.9% over 1 hour. If eGFR 15-30 ml/min, administer over 4 hours. If eGFR<15ml/minute, administer over 6 hours.

B) Moderate hypomagnesaemia (0.3-0.5 mmol/l)

This should be treated by intravenous infusion of **between 2–5 g (8-20 mmol) magnesium (4-10 ml magnesium sulphate 50% injection), depending on plasma magnesium level, in 100ml sodium chloride 0.9% over 1 hour** if renal function is normal**.** Recheck plasma magnesium in 24 hours and repeat treatment if required or earlier if patient is symptomatic.

If renal impairment:
eGFR 15-30 ml/min 2 g (8 mmol) magnesium (4 ml magnesium sulphate 50% injection) in 100 ml sodium chloride over 4 hours. ***Recheck plasma magnesium 4 hours after infusion to exclude accumulation of magnesium.***
eGFR<15 ml/min 2 g (8 mmol) magnesium (4 ml magnesium sulphate 50% injection) in 100 ml sodium chloride over 6 hours. ***Recheck plasma magnesium 4 hours after infusion to exclude accumulation of magnesium.***

C) Severe hypomagnesamia (<0.3 mmol/l)

This should be treated by intravenous infusion of **7 g (28 mmol) magnesium (14 ml magnesium sulphate 50% injection) in 250ml sodium chloride 0.9% over 2 hours** if renal function is normal. Recheck plasma magnesium in 24 hours and repeat treatment if required or earlier if patient is symptomatic. Symptomatic patients, such as those with tetany, arrhythmias, or seizures should have continuous cardiac monitoring

If renal impairment:

| | |
|---|---|
| eGFR 15-30 ml/min | 2-4 g (8-16 mmol) magnesium (4-8 ml of magnesium sulphate 50% injection) in 100ml sodium chloride 0.9% over 4 -12 hours. ***Recheck plasma magnesium 4 hours after infusion to exclude accumulation of magnesium.*** |
| eGFR<15 ml/min | 2-4 g (8-16 mmol) magnesium (4-8 ml of magnesium sulphate 50% injection) in 100ml sodium chloride 0.9% over 6 -12 hours. ***Recheck plasma magnesium 4 hours after infusion to exclude accumulation of magnesium.*** |

When correcting severe hypomagnesaemia in addition to close laboratory monitoring the patient should be monitored for clinical signs of hypermagnesemia such as facial flushing, decreased tendon reflexes, hypotension and atrioventricular block.

The average total deficit in hypomagnesaemia is 0.5-1 mmol/kg. Subsequent replacement doses should be titrated with the plasma magnesium level and the patient's clinical state (doses are usually between 2-7 g or 8-28 mmol magnesium). Daily infusions may be required for up to 5 days.

Preparation and administration of intravenous magnesium infusion

The preparation of an intravenous magnesium infusion must be second checked by another member of medical/nursing or pharmacy staff, including a check of any calculations. The administration of all intravenous magnesium infusions must be second checked, including the rate setting on the infusion device.

Caution

Magnesium should be administered with caution to patients with renal impairment and also in patients with recurrent renal stones, severe bradycardia, respiratory insufficiency or myasthenia gravis.

Monitoring for side-effects and toxicity

Possible side effects (due to hypermagnesaemia) are very unlikely with magnesium replacement doses in patients with normal renal function. Side effects include flushing, thirst, nausea and vomiting, depression of reflexes, drowsiness, hypotension, bradycardia, cardiac arrhythmias, respiratory depression and coma. In very rare circumstances hypocalcaemia may occur. Patients should be routinely observed and monitored for these.

| **Magnesium Concentration** | **Possible Signs of Magnesium Toxicity** |
|---|---|
| 2-3.5 mmol/l | Flushing, ECG changes |
| 4-5 mmol/l | Drowsiness, slurred speech, absent deep tendon reflexes |
| >6 mmol/l | Muscle paralysis, respiratory depression |
| >8 mmol/l | Cardiac arrest |

In the exceptional circumstance of severe symptomatic hypermagnesaemia (e.g. accidental overdose) seek senior clinical advice and give 10 ml calcium gluconate 10% (2.25 mmol calcium) over 10 minutes and repeat as required

### 3. Treatment of Hyponatraemia in Adults

See the SET Guideline Statement for Hyponatraemia in Adults on iConnect.

### 4. Treatment of Hypophosphataemia in Adults

See the SET Guidance on Treatment of Hypophosphataemia in Adults on iConnect.

### 5. Emergency Endocrine Guidance: Acute Hypocalcaemia for Use in Adult Patients

A Society for Endocrinology guidance document is available on iConnect.

### 6. Emergency Endocrine Guidance: Acute Hypercalcaemia

A Society for Endocrinology guidance document is available on iConnect.

### 7. Guidelines for Treatment of Hyperkalaemia in Adults

See the SET Guidelines for the Treatment of Hyperkalaemia in Adults on iConnect.

## 8. Suspect Cardiac Chest Pain Pathway

***(Troponin values on this guideline refers to Laboratory high sensitivity Troponin and not POCT results)***

- This pathway is based on recent European guidance and incorporates the Heart score for additional risk stratification (1-4)
- This pathway only applies to patients presenting with **chest pain**.
- **Caution in early presenters** – timing of onset or worst pain <3 hours will need T0 + T1+T3.
- Renal dysfunction-elevations in cardiac troponin should not be primarily attributed to impaired clearance unless the eGFR is <30 and there are no features in the history or examination suggestive of an acute cardiac cause.
- T0 = baseline/arrival TnT (high sensitivity troponin T)
- T1 = 1 hour TnT
- T3 = 3 hour TnT
- Δ= absolute delta change between T0 and T1 troponin samples
- The observation group represents those patients requiring further assessment and a 3 hour troponin sample.
- A T3 Δ result reverts back to a % change. A change of > 20 % between T1 and T3 values with one value >12ng/l may be consistent with a diagnosis of ACS
- Normal ECG – no ST elevation, ST depression, T inversion and complete left bundle branch block.
- Low HEART scores (values 0–3) were calculated in 36.4% of the patients. MACE occurred in 1.7%. In patients with HEART scores 4–6, MACE was diagnosed in 16.6%. In patients with high HEART scores (values7–10), MACE occurred in 50.1%.

Cardiac causes of elevated troponin

- Severe/prolonged tachyarrhythmia
- Heart failure
- Myocarditis/myopericarditis
- Tako-Tsubo cardiomyopathy
- Structural heart disease (e.g. aortic stenosis)
- Defibrillation- external or internal
- Cardiac procedures e.g. CABG/PCI/ablation/ pacing/cardiac biopsy
- Aortic dissection
- Coronary spasm
- Cardiac contusion

Non-cardiac causes of elevated troponin

- Critical illness (e.g. shock/sepsis/burns)
- Pulmonary embolism/pulmonary hypertension
- Acute exacerbation of COPD
- Subarachnoid haemorrhage/stroke/intracranial in haemorrhage
- End stage renal disease
- Strenuous exercise/marathons/triathlons ·Rhabdomyolysis
- Infiltrative disease eg. Amyloidosis/ haemochromatosis, sarcoidosis, scleroderma
- Hypo/hyperthyroidism
- Toxins and venoms including carbon monoxide poisoning, cyanide poisoning
- Drug toxicity
- Seizures

**See overleaf for a flowchart of the Suspected Cardiac Chest Pain Pathway.**

**Patient attending ED with suspected 'Cardiac Chest Pain'**

ECG and T0

High risk ECG (STEMI or ischaemic) OR Haemodynamically unstable

NO

YES

Collate & interpret results of ECG, T 0 and document HEART score

Move to resus area

- Cardiac monitor
- IV
- Access
- ABCDE approach and seek senior help
- Diagnosis STEMI: Contact Primary PCI coordinator, fax ECG and administer Aspirin 300mg & titrate IV Opiates
- Consider non ACS differentials (eg aortic dissection, PE, tension pneumothorax

**HEART**

| HEART score for chest pain patients | | | |
|---|---|---|---|
| History | Highly suspicious | 2 | |
| | Moderately suspicious | 1 | |
| | Slightly suspicious | 0 | |
| ECG | Significant ST-deviation | 2 | |
| | Non specific repolarisation disturbance / LBTB / PM | 1 | |
| | Normal | 0 | |
| Age | ≥ 65 years | 2 | |
| | > 45 and < 65 years | 1 | |
| | ≤ 45 years | 0 | |
| Risk factors | ≥ 3 risk factors or history of atherosclerotic disease* | 2 | |
| | 1 or 2 risk factors | 1 | |
| | No risk factors known | 0 | |
| Troponin | ≥ 3x normal limit | 2 | |
| | > 1 and < 3x normal limit | 1 | |
| | ≤ 1x normal limit | 0 | |
| | | Total | |

| | |
|---|---|
| MACE | Major adverse cardiac event |
| HScTnT | high sens troponin T |
| T0 | HScTnT on arrival time 0 |
| T1 | HScTnT 1 hr after initial TO |
| T3 | HscTnT 3 hrs after initial TO |
| Δ | Delta change either % or ng/L of troponin |

**Low Risk HEART score (0-3)** **And** T0 <5ng/L **And** > 3hrs post pain **And** pain free **And** normal ECG

→ Non cardiac chest pain. Consider differential diagnosis. No further cardiac work required. No need for T1. Consider referral to RACPC if exertional symptoms/ pain eased with rest or GTN.

**Low risk HEART score (0-3)**

And T0 ≥5ng/L
or <3hrs from onset
or non-specific ECG changes

→ Perform T1 and repeat ECG

Rule out if TO <12ng/L AND Δ <3 ng/L - Discharge if non-ischaemic ECG and no TnT rise of >2. Consider referral to RACPC if exertional symptoms/ pain eased with rest or GTN.

**Moderate risk HEART score (4-6)**

→ Perform T0 + 1
Δ <3 ng/L with no ongoing chest pain & non-ischaemic ECG
Discharge with ED Consultant discretion and refer to RACPC if exertional symptoms / pain eased with rest or GTN

T0/1 ≥ 52ng/L or T0/1 Δ ≥ 5ng/L admit under cardiology &treat as ACS in the context of cardiac chest pain

**Low-moderate HEART score (0-6) requiring T3**

→ Need T3 if - T0 <12 and Δ 3 or 4 ng/L
Or T0 ≥ 12-51

Rule in likely AMI- T0/T3 rise ≥ 20 % - admit under cardiology &treat as NSTEMI in the setting of cardiac chest pain.

Rule out AMI - T0/T3 rise < 20 % HEART 0-3 discharge
HEART 4-6 discharge at ED consultant discretion only, possible admission

**High risk HEART Score (7-10)**

**6 week MACE 73%**

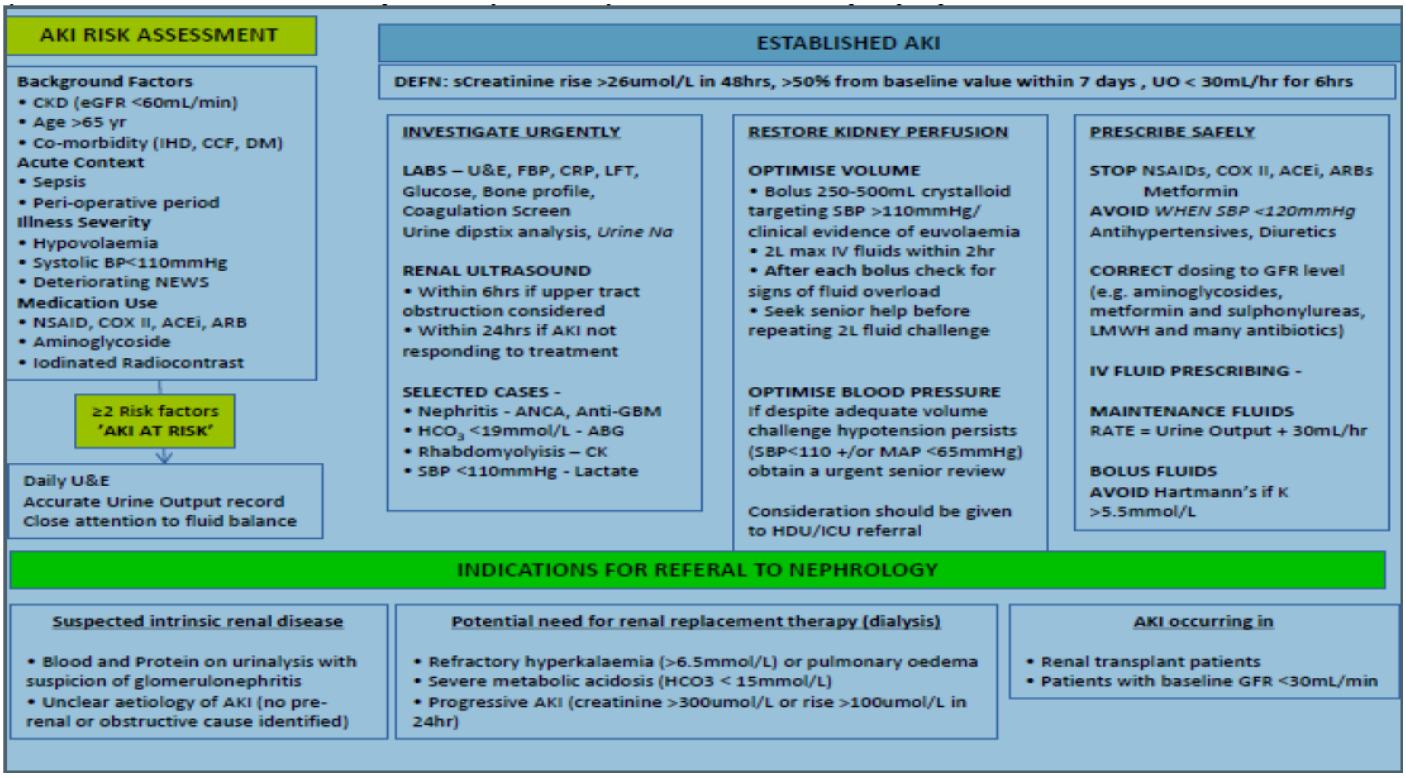
→ Admit under Cardiology & treat as NSTEMI in the context of cardiac chest pain.

**Irrespective** of HEART score

→ Admit under Cardiology & treat as NSTEMI if cardiac chest pain and

T0/T1 rise ≥ 5 ng/L in the context of cardiac chest pain
T0/T3 rise ≥ 20% in the context of cardiac chest pain
A rise of >50% is highly suggestive of NSTEMI
A TnT >52ng/L in the context of cardiac chest pain and normal renal function is strongly suggestive of ACS.

## 9. Acute Kidney Injury (AKI) Alert – GAIN Guidance 2014




Acute kidney injury (AKI) is common, often preventable and associated with high morbidity and mortality. It is diagnosed by a reduction in urine output or a rise in plasma creatinine from a baseline value. Delay in diagnosing AKI or failure to recognise AKI significantly contributes to the poor outcomes of patients with AKI. There is therefore an urgent need to improve early recognition of AKI. The development of electronic alert systems (e-alerts) for AKI would seem to be an effective way of doing this. The electronic alert system uses Laboratory data to 'flag' or 'alert' when a patient has a change in plasma creatinine level, which may identify that patient as having AKI. This 'alert' will appear on the screen when the creatinine result is looked up. The responsibility for looking up the result and taking the appropriate clinical action remains with the clinician(s) responsible for the patient.

The electronic alert systems are not designed to replace timely clinical investigation, examination and management of patients but are an additional 'warning system'. It is hoped that electronic alert systems for AKI combined with better identification of the 'at risk' patient and improved clinical assessment will trigger earlier recognition and management of persons with AKI. This should improve patient outcomes.

## 10. Further Guidance

Further advice may be sought at any time from the Consultant Chemical Pathologist or the Consultant Clinical Biochemist, at the Ulster Hospital Clinical Biochemistry Laboratory.

**THERAPEUTIC DRUG MONITORING**

The clinical application of therapeutic drug monitoring is limited to those drugs where a correlation between plasma concentration and therapeutic effect has been demonstrated. Drug plasma levels should be monitored when a patient exhibits toxicity on a 'normal' dosage regimen, when adjusting a dosage regimen, changing formation or adding a drug, for confirmation of adequacy of treatment or when non-compliance or overdose is suspected.

The **timing of the specimen in relation to dosage is critical** for correct interpretation of the result. Collection times should be based on the individual pharmacokinetic properties of the drug, formulation and route of administration.

The following are general guidelines only:-

| **Specimen type** | **Sampling time** |
|---|---|
| Trough level | Immediately before next dose |
| Peak level (IV) | 15-30 minutes after a 30 minute infusion |
| | 0-15 minutes after a 60 minute infusion |
| | 0-15 minutes after a bolus injection |
| Peak level (IM) | 30-60 minutes after injection |
| Peak level (oral) | 1-3 hours after oral dose |
| | 4 hours after sustained release preparation |
| Steady state level | Drawn after five elimination half-lives (t ) have elapsed. |

Interpretation of results should be in light of the clinical situation using information which includes:-

- Renal function (i.e. plasma creatinine/creatinine clearance)
- Hepatic function
- Patient age, weight and sex
- Dosage regimen and dosage form of drug
- List of concurrent drug therapy
- Time the specimen was obtained
- Clinical status of the patient

The specimen requirements and therapeutic interval for drug monitoring can be found within Test and Reference Values. For further information on sampling times or interpretation or drug plasma levels, please contact the Pharmacy – Ext 82655. Pharmacy can advise on the dosage level required to achieve a 'therapeutic' drug level when the above information is provided.

| DRUG | ELIMINATION HALF-LIFE [t½] (HOURS) |
|---|---|
| Amphetamine | 5-21 |
| Amitryptiline | 19 |
| Carbamazepine | Long Term Use: 7-25, Single Dose: 25-45 |
| Diazepam | 24 – 48 |
| Digoxin | 40 |
| Nortryptiline | 28 |
| Paracetemol | 2.5 |
| Phenobarbitone | 50-140 |
| Phenytoin | Chronic Administration: 15-100, Single Dose: 9-22 |
| Quinidine | Approx. 6.0 |
| Salicylate | 2-30 |
| Theophylline | Adults: 9.3, Neonates: >8.3 |
| Valproic acid | 7-14 |

**Table 1: Drug Half-Life**

Plasma assays are required for certain antibiotic agents to ensure therapeutic but non-toxic levels are achieved. Therapeutic Drug Monitoring assays, including Gentamicin, Teicoplanin, and Vancomycin, are carried out in Clinical Biochemistry, with Amikacin and Tobramycin referred to BHSCT. Any specimens for these assays should be sent directly to the Ulster Hospital Clinical Biochemistry Laboratory; however clinical advice in regards to the above antibiotic assays can only be obtained from the Consultant Microbiologists.

Specimen:
Adult: 5-10ml peripheral venous blood in green topped Li. Hep. tube
Children: 0.4ml peripheral venous blood in green topped tube

*Note – Trough levels should be taken just before the next dose and peak levels taken 60 minutes after the dose, unless indicated otherwise in accompanying table.*

For all assays it is essential that the following information be provided on the request form:

- Time and date of commencement
- Record on both forms & specimens whether specimens are pre- or post-dose or peak related

Monitoring once daily Teicoplanin therapy – specimens obtained out of hours will not normally be processed until the following morning. This should still allow sufficient time for dose adjustment prior to next due dose. To facilitate this arrangement it is best to avoid dosing times between 9-11am.

| ANTIBIOTIC | DOSAGE | REFERENCE INTERVAL | MONITORING |
|---|---|---|---|
| **Amikacin**<br>(Adults on once daily regimen)<br><br>*Note: dosing, monitoring and target levels differ for neonates* | 15 mg/kg 24 hourly (in 100ml 5% glucose or 0.9% NaCl over 30 minutes – 1 hour) | <5 mg/L | • Take a sample 19-24 hours after the first dose<br>• Await level<br>• If level is less than 5mg/L - continue on same dose every 24 hours. Recheck level every 3 days or earlier if impaired or deteriorating renal function.<br>• If level is greater than 5mg/L - withhold dose and resample after a further 19-24 hours (43-48 hours post dose). If then less than 5mg/L - continue on same dose every 48 hours. If level remains greater than 5mg/L - contact microbiology or antimicrobial pharmacist for advice. |
| **Gentamicin**<br>(Adults on once daily regimen)<br><br>*Note: Paediatrics / Neonates / ICU / divided dose regimen – please see Trust guidelines for monitoring gentamicin* | 5mg/kg 24 hourly (in 100ml 5% glucose or 0.9% NaCl over 30 minutes – 1hour) | <1 mg/L | • Take a sample 19-24 hours after the first dose<br>• Await level<br>• If level is less than 1mg/L - continue on same dose every 24 hours. Recheck level every 3 days or earlier if impaired or deteriorating renal function.<br>• If level is greater than 1mg/L - withhold dose and resample after a further 19-24 hours (43-48 hours post dose). If then less than 1mg/L - continue on same dose every 48 hours. If level remains greater than 1mg/L - contact microbiology for advice |
| **Teicoplanin**<br>(Levels only required in severe infections, e.g. bacteraemia, OR prolonged therapy, e.g. osteomyelitis, endocarditis) | See SET Empirical Antimicrobial Therapy Guidelines for Hospitalised Adults (iConnect) | | • Check trough level pre first maintenance dose (before 6th dose).<br>• Give dose while awaiting result.<br>• Target trough range is ≥20<br>• Adjust dosing interval / dose according to levels. Contact microbiology or antimicrobial pharmacist for advice if levels outside the normal range. |
| **Tobramycin**<br>(Adults on once daily regimen)<br><br>*Note: dosing, monitoring and target levels differ for neonates* | 3mg/kg 24 hourly **OR** 5mg/kg 24 hourly (in 100ml 5% glucose or 0.9% NaCl over 30 minutes – 1 hour) | <1 mg/L | • Take a sample 19-24 hours after the first dose and await level.<br>• If level is less than 1mg/L - continue on same dose every 24 hours. Recheck level at every 3 days or earlier if impaired or deteriorating renal function.<br>• If level is greater than 1mg/L - withhold dose and resample after a further 19-24 hours (43-48 hours post dose). If then less than 1mg/L - continue on same dose every 48 hours<br>• If level remains greater than 1mg/L - contact microbiology or antimicrobial pharmacist for advice |

| ANTIBIOTIC | DOSAGE | REFERENCE INTERVAL | MONITORING |
|---|---|---|---|
| **Vancomycin** (Adults) | See SET Empirical Antimicrobial Therapy Guidelines for Hospitalised Adults (iConnect) | | • Measure pre-dose (trough) levels at the end of the dosage interval in the hour before the next dose due.<br>• Timing of first level is dependent on estimated CrCl - see Trust Guidelines<br>• Give dose while awaiting level unless renal function unstable and/or toxicity suspected.<br>• Target trough range: 10-15mg/L (for severe deep seated infections target range: 15-20mg/L).<br>• Contact Microbiology or antimicrobial pharmacist for advice if levels outside target range.<br>• Monitor U+E (serum creatinine) daily and escalate to senior medical staff if deteriorates. |

***For further information, please consult the SET Empirical Antimicrobial Therapy Guidelines for Hospitalised Adults , available on iConnect, or these further guidance documents:***

- Guidelines for the prescribing, administration and monitoring of intravenous aminoglycosides in adults excluding ICU/HDU (SET/Guide (21) 2017)
- Prescribing, Administration and Monitoring of Gentamicin in Neonates Policy Statement (SET/PtCtCare (102) 2020)
- Guidelines for the prescribing, administration and monitoring of intravenous Teicoplanin in adults (SET/Guide (09) 2022)
- Guidelines for the prescribing, administration and monitoring of intravenous Vancomycin in adults (SET/Guide (20) 2017)

**SEHSCT Trust Medicines Information Service:**
medicine.information@setrust.hscni.net Tel: 028 905 61445

**Regional Medicines & Poison Information Service:**
nirdic.nirdic@belfasttrust.hscni.net Tel: 028 906 32032 / 028 906 33847

**National Poisons Information Service:**
https://www.npis.org/ Tel: 0344 892 0111
www.TOXBASE.org

# HAEMATOLOGY & BLOOD TRANSFUSION

*A UKAS accredited medical laboratory No. 8029*

*The laboratory's full schedule of accreditation, listing accredited tests, can be found on the UKAS website. Any tests not on the schedule are highlighted throughout this section.*

## HAEMATOLOGY & BLOOD TRANSFUSION CONTACT DETAILS

| | |
|---|---|
| **CONSULTANT HEAD OF HAEMATOLOGY & BLOOD TRANSFUSION:** | Dr M. Bowers<br>margaret.bowers@setrust.hscni.net |
| **CONSULTANT HAEMATOLOGIST:** | Dr R. McCormick<br>Rachel.McCormick@setrust.hscni.net |
| **CONSULTANT HAEMATOLOGIST:** | Dr Y. L. Ong<br>yonglee.ong@setrust.hscni.net |
| **CONSULTANT HAEMATOLOGIST:** | Dr N. Sharma<br>Narind.Sharma@setrust.hscni.net |
| **CONSULTANT HAEMATOLOGIST:** | *Vacant* |
| **HAEMATOLOGY CONSULTANT'S SECRETARY (Dr Bowers/ Dr McCormick/ Dr Ong (Mon–Thurs 8am–4pm)):** | 028 9041 1696 / Ext. 21550 |
| **HAEMATOLOGY CONSULTANT'S SECRETARY (Vacant/ Dr Sharma (Mon–Fri 8am–2pm)):** | 028 9041 1697 / Ext. 21552 |
| **HAEMATOLOGY & BLOOD TRANSFUSION HEAD BIOMEDICAL SCIENTIST:** | Neil Kirkpatrick<br>028 9041 1572 / Ext 21541<br>neil.kirkpatrick@setrust.hscni.net |
| **HAEMOVIGILANCE PRACTITIONERS:** | Louann Birch<br>028 9041 1574 / Ext 21904<br>louann.birch@setrust.hscni.net<br><br>Lorna Palmer<br>028 9041 1573 / Ext 21903<br>lorna.palmer@setrust.hscni.net |
| **GENERAL ENQUIRIES:** | 028 9041 1701 / Ext. 21554 |
| **BLOOD TRANSFUSION:** | 028 9041 1529 / Ext. 21506 |
| **COAGULATION:** | 028 9041 1531 / Ext. 11596 / 22264 |
| **HAEMATOLOGY:** | 028 9041 1532 / Ext. 21508 |
| **OUT-OF-HOURS BIOMEDICAL SCIENTIST:** | 52262 / 07712853930 |

## GENERAL INFORMATION

For electronic orders (Encompass) **routine specimens** must be labelled with an Encompass label, put into the relevant Laboratory specimen bag and sent on to the Laboratory.
For manual orders (GP) **routine specimens** must be labelled and placed in the special plastic bag attached to the appropriate request form, and sealed. Specimens must not be sent in standard envelopes via the internal post.
All **high-risk specimens** from suspected or known cases of TB, CJD, Hepatitis B & C, and HIV infection, etc must be treated as potentially infectious. They must be sent to the laboratory in an appropriate container, which must be labelled with a biohazard label "Danger of Infection - Take special care". **The biohazard label must be attached to both the specimen and request form,** where applicable.
All persons who use the laboratory service are reminded that they must comply with the legal requirements under the Health and Safety at Work Order (NI 1978) and COSHH regulations (2002).

## TURNAROUND TIMES

Results for **emergency** requests are available **90 minutes** after receipt by the Laboratory. **Ward requests** received between 9am and 4pm will have results available within **4 hours** of specimen receipt or within the specified turnaround time stated for a specific test. Where possible most **routine requests** are reported **within 1 working day** or within the specified turnaround time stated for a specific test. The Laboratory aims to process 95% of requests within these stated turnaround times, however the turnaround times for some requests, including referrals and regional tests, may be extended if they require further investigation.

## OUT-OF-HOURS SERVICE

Do not use the routine clear pathology specimen bag or joint Biochemistry-Haematology request forms for urgent haematology requests, please use the Urgent Haematology specimen bags / request forms (pink). Outside of normal laboratory hours a medical officer can request all urgent blood tests by contacting the On-Call Haematology BMS. Please indicate where and to whom these reports should be returned or telephoned. To contact the On-Call Haematology BMS call 52262 / 07712853930. The table below shows the tests that are available as an emergency.

| HAEMATOLOGY & BLOOD TRANSFUSION<br>TESTS AVAILABLE AS URGENT REQUESTS |
|---|
| Activated Partial Thromboplastin Time (APTT) for unfractionated heparin monitoring |
| Blood Grouping, Antibody screening and Cross-matching |
| Blood and Blood Product Issue |
| Coagulation Screen |
| D-Dimer (specific request) for exclusion of VTE – needs a Wells score |
| Direct Coombs Test |
| Emergency Grouping of Maternal and Fetal specimens for the Issue of Anti-D Immunoglobulin |
| ESR for suspected temporal arteritis |
| Estimation of Feto-Maternal Haemorrhage (Kleihauer)-only after consultation with BMS staff |
| Full Blood Count including platelets, automated differential and Manual DWCC |
| International Normalised Ratio (INR) – oral anticoagulant monitoring |
| Malaria Parasites |
| Sickle Cell Screen |

# HAEMATOLOGY

## 1. FBC & DWCC

Specimen Requirements:

Adult: 1 x purple topped EDTA specimen tube
*(Recommended minimum volume = 4ml)*

Paediatric: 1 x purple topped paediatric EDTA tube
*(Recommended minimum volume = 0.5ml)*

### Adult Reference Intervals

| FBC | UNIT | REFERENCE INTERVAL | |
|---|---|---|---|
| | | MALE | FEMALE |
| Hb | g/l | 130 - 170 | 120 - 150 |
| RBC | $10^{12}$/l | 4.5 - 5.5 | 3.8 - 4.8 |
| HCT | l/l | 0.40 - 0.50 | 0.36 - 0.46 |
| MCV | fl | 83- 101 | 83 - 101 |
| MCH | pg | 27 - 32 | 27 - 32 |
| MCHC | g/l | 315 - 345 | 315 - 345 |
| Platelet | $10^9$/l | 150 - 410 | 150 - 410 |
| WBC | $10^9$/l | 4 - 10 | 4 - 10 |
| RDW | % | 11.6-14.0 | 11.6-14.0 |

| DWCC | UNIT | REFERENCE INTERVAL | |
|---|---|---|---|
| | | MALE | FEMALE |
| Neutrophil | x$10^9$/l | 2.0 - 7.0 | 2.0 - 7.0 |
| Lymphocyte | x$10^9$/l | 1.0 - 3.0 | 1.0 - 3.0 |
| Monocytes | x$10^9$/l | 0.2 - 1.0 | 0.2 - 1.0 |
| Eosinophils | x$10^9$/l | 0.02 - 0.50 | 0.02 - 0.50 |
| Basophils | x$10^9$/l | 0.02 - 0.10 | 0.02 - 0.10 |

### Paediatric Reference Intervals

| FBC | UNIT | REFERENCE INTERVAL | | | | | |
|---|---|---|---|---|---|---|---|
| | | BIRTH | DAY 3 | DAY 7 | 1 MONTH | 2 MONTHS | 3- 6 MONTHS |
| Hb | g/l | 140-220 | 150 - 210 | 135-215 | 115-165 | 94 - 130 | 111 - 141 |
| RBC | x$10^{12}$/l | 5.0-7.0 | 4.0 - 6.6 | 3.9-6.3 | 3.0-5.4 | 3.1 - 4.3 | 4.1 - 5.3 |
| HCT | l/l | 0.45-0.75 | 0.45 - 0.67 | 0.42-0.66 | 0.33-0.53 | 0.28- 0.42 | 0.30 - 0.40 |
| MCV | fl | 100-120 | 92 - 118 | 88-126 | 92-116 | 87 - 103 | 68-84 |
| MCH | pg | 31.0-37.0 | 31.0-37.0 | 31.0-37.0 | 30.0-36.0 | 27 - 33 | 24 - 30 |
| MCHC | g/l | 300-360 | 290 - 370 | 280-370 | 290-370 | 285 - 355 | 300 - 360 |
| Platelet | x$10^9$/l | 100-450 | 210 - 500 | 160-500 | 200-500 | 210 - 650 | 200 - 450 |
| WBC | x$10^9$/l | 10.0-26.0 | 7 – 23.0 | 6.0-22.0 | 5.0-19.0 | 5.0– 15.0 | 6.0 – 18.0 |

| FBC | UNIT | REFERENCE INTERVAL | | |
|---|---|---|---|---|
| | | 1 YEAR | 2-6 YEARS | 6-12 YEARS |
| Hb | g/l | 111-141 | 110-140 | 115-155 |
| RBC | $x10^{12}$/l | 3.9-5.1 | 4.0 -5.2 | 4.0-5.2 |
| HCT | l/l | 0.30-0.38 | 0.34-0.40 | 0.35-0.45 |
| MCV | fl | 72-84 | 75-87 | 77-95 |
| MCH | pg | 25-29 | 24-30 | 25-33 |
| MCHC | g/l | 320-360 | 310-370 | 310-370 |
| Platelet | $x10^{9}$/l | 200-550 | 200-490 | 170-450 |
| WBC | $x10^{9}$/l | 6.0-16.0 | 5.0-15.0 | 5.0-13.0 |

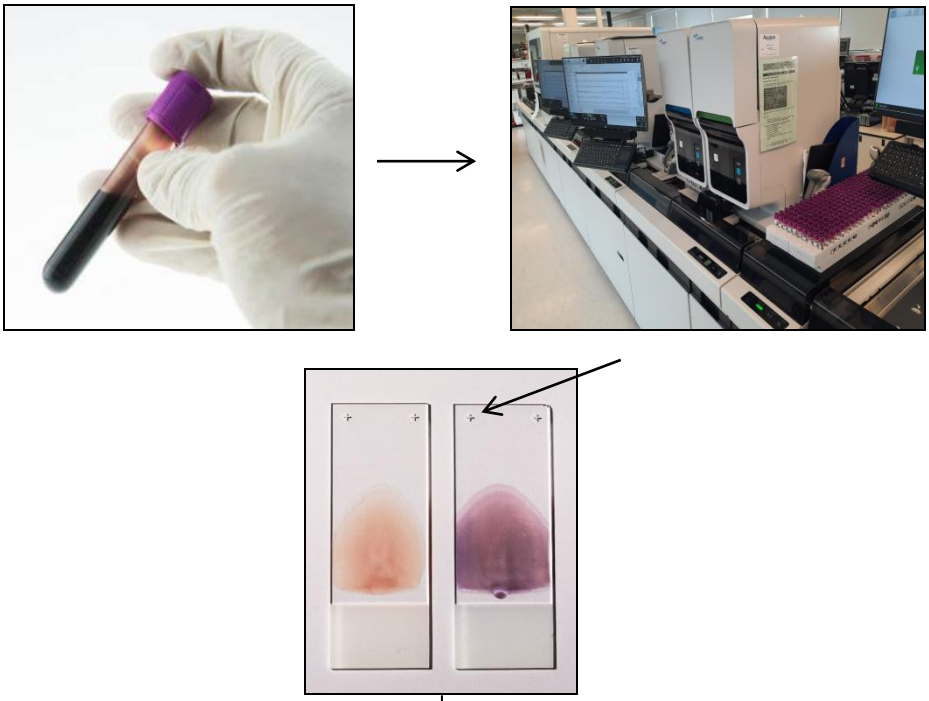
| DWCC | UNIT | REFERENCE INTERVAL | | | | | |
|---|---|---|---|---|---|---|---|
| | | BIRTH | DAY 3 | DAY 7 | 1 MONTH | 2 MONTHS | 3- 6 MONTHS |
| Neutrophil | $x10^{9}$/l | 4.0-14.0 | 3.0-5.0 | 3.0-6.0 | 3.0-9.0 | 1.0-5.0 | 1.0-6.0 |
| Lymphocyte | $x10^{9}$/l | 3.0-8.0 | 2.0-8.0 | 3.0-9.0 | 3.0-16.0 | 4.0-10.0 | 4.0-12.0 |
| Monocyte | $x10^{9}$/l | 0.5-2.0 | 0.5-1.0 | 0.1-1.7 | 0.3-1.0 | 0.4-1.2 | 0.2-1.2 |
| Eosinophil | $x10^{9}$/l | 0.1-1.0 | 0.1-2.0 | 0.1-0.8 | 0.2-1.0 | 0.1-1.0 | 0.1-1.0 |
| Basophil | $x10^{9}$/l | 0.02-0.1 | 0.02-0.1 | 0.02-0.1 | 0.02-0.1 | 0.02-0.1 | 0.02-0.1 |

| DWCC | UNIT | REFERENCE INTERVAL | | |
|---|---|---|---|---|
| | | 1 YEAR | 2-6 YEARS | 6-12 YEARS |
| Neutrophil | $x10^{9}$/l | 1.0-7.0 | 1.5-8.0 | 2.0-8.0 |
| Lymphocyte | $x10^{9}$/l | 3.5-11.0 | 6.0-9.0 | 1.0-5.0 |
| Monocyte | $x10^{9}$/l | 0.2-1.0 | 0.2-1.0 | 0.2-1.0 |
| Eosinophil | $x10^{9}$/l | 0.1-1.0 | 0.1-1.0 | 0.1-1.0 |
| Basophil | $x10^{9}$/l | 0.02-0.1 | 0.02-0.1 | 0.02-0.1 |

The values of haematology parameters change markedly during the first weeks and months of life. Reference data for the paediatric age groups should be referred to until the age at which normal adult reference intervals can be applied.

## 2. BLOOD FILM REQUESTS

All FBC samples received by Haematology Laboratory, Ulster Hospital have analysis performed on the Sysmex XN Haematology analysers. When haematological abnormalities are detected (analyser flags or abnormal full blood count parameters), blood films are prepared, examined and commented on as necessary by Biomedical Scientists, therefore it is not usually necessary to request a film:



Suggestive of Iron Deficient Anaemia (Microcytosis & Hypochromia)

Suggestive of Infectious Mononucleosis (Atypical Mononuclear Cell)

Suggestive of CML (Blast Cell plus mature & immature cells of myeloid lineage)

However, ***if on the rare occasion***, a Clinician feels a blood film is required for a specific reason then ***that reason and relevant clinical details should be included on the request form/added to the Encompass request***. A blood film request without Clinical Details may be rejected.

**3. ESR**

Specimen Requirements: Completed on FBC specimen
*(Adult: Recommended minimum volume = 4ml*
*Paediatric: Recommended minimum volume = 3ml)*

Reference Interval: Varies with age and sex (see table below)

| UNIT | SEX | REFERENCE INTERVAL | | |
|---|---|---|---|---|
| | | UP TO 50 YEARS | UP TO 70 YEARS | ≥ 70 YEARS |
| mm/hr | Male | 1 - 10 | 1 - 15 | 1 - 30 |
| mm/hr | Female | 1 - 12 | 1 - 20 | 1 - 35 |

**4. Reticulocytes**

Specimen Requirements: Completed on FBC specimen
*(Recommended minimum volume = 4ml)*
Reference Interval: < 2 %

**5. Malarial Parasites**

Specimen Requirements: 1 x purple topped EDTA specimen
*(Recommended minimum volume = 4ml)*
Blood films will be made in the laboratory
Please ensure the Malaria Investigation Request Form is completed & sent with each request. Samples received without the request form will not be processed – ***see Appendix G for the request form / if ordering via Encompass please complete malaria questionnaire on Encompass.***
Specific Turnaround Time: Interim report – 4 hours
Full report – 24 hours

**6. Sickle Cell Screen**

Specimen Requirements: 1 x purple topped EDTA specimen
*(Recommended minimum volume = 4ml)*

**7. Urinary Haemosiderin**

Specimen Requirements: 20 ml fresh urine in a universal container
Specific Turnaround Time: 48 hours

**8. Plasma Viscosity**

Specimen Requirements: 1 x purple topped EDTA specimen
*(Recommended minimum volume = 4ml)*
Reference Interval: 1.50 – 1.72 mPa.s
Specific Turnaround Time: 1 week

**8. Glandular Fever Screen (GFS) / Infectious Mononucleosis (IM) Test**

Specimen Requirements: 1 x purple topped EDTA / yellow topped gel / red topped clotted specimen
*(Recommended min. vol. = 4ml (purple) / 3.5ml (yellow) / 1ml (red))*
Specific Turnaround Time: 1 day

**9. Bone Marrow Examination**

Morphological, Immunophenotypic and Cytogenetic features of blood cells and their precursors may contribute to the diagnosis and monitoring of various haematological conditions. The test is by arrangement with a Consultant Haematologist. Turnaround Time is usually 6-8 weeks but may take substantially longer if further investigation is required.

## 10. Other Tests Available As Referral/Regional Tests

*For Haemochromatosis, Haemoglobinopathies, Jak2, Peripheral Blood Markers, PNH Screen, G6PD & Pyruvate Kinase etc., please check Belfast HSCT Haematology Laboratory User Manual for up to date information on sample type, sample volume, TATs and guidelines. Please ensure date, time and signature are included on all request forms for Belfast HSCT Labs and also include relevant clinical details and the test(s) required.*

- Erythropoietin (EPO)
  1 x purple-topped EDTA /
  1 x red-topped clotted specimen
  *(Recommended minimum volume = 6ml)*
  Specific Turnaround Time: <3 weeks
- Haemochromatosis Gene
  1 x purple-topped EDTA specimen
  *(Recommended minimum volume = 4ml)*
  Signed, timed and dated BCH Haematology request form marked: Special Investigations Haematology c/o Haematology Lab, Floor C, Tower Block, BCH
  *See Belfast Trust Laboratories User Manuals for full acceptance criteria – available at https://belfasttrust.hscni.net/service/laboratory-services/*
  Specific Turnaround Time: <3 weeks
- Haemoglobin $A_2$, F
  1 x purple-topped EDTA specimen
  *(Recommended minimum volume = 4ml)*
  Specific Turnaround Time: <3 weeks
- Haemoglobin electrophoresis
  1 x purple-topped EDTA specimen
  *(Recommended minimum volume = 4ml)*
  Specific Turnaround Time: <3 weeks
- Jak2
  1 x purple-topped EDTA specimen
  *(Recommended minimum volume = 4ml)*
  Specific Turnaround Time: 1-2 months
- Peripheral blood markers (flow cytometry)
  2 x purple-topped EDTA specimen
  *(Recommended minimum volume = 4ml X 2)*
  Specific Turnaround Time: <3 weeks
- PNH screen (flow cytometry)
  1 x purple-topped EDTA specimen
  *(Recommended minimum volume = 4ml)*
  Specific Turnaround Time: 1 month
  *Note: On Fridays samples must be received in BCH before 3pm for testing. Any later samples will be rejected.*
- Red blood cell enzymes (G6PD, Pyruvate Kinase)
  1 x purple-topped EDTA specimen
  *(Recommended minimum volume = 4ml)*
  Specific Turnaround Time: 1 week

If you have any queries regarding the tests listed above, these can be discussed with a Haematology Consultant.

## 11. Reference Intervals

Sources of reference intervals are available from the Laboratory.

# COAGULATION

***For all coagulation tests addition of the correct volume of blood to the container is essential.***

The following tests are routinely available and must be sent in a blue top citrated specimen tube:

- International Normalised Ratio (INR) for Warfarin monitoring
  *(Recommended minimum volume = 2.7ml)*
- Activated Partial Thromboplastin Time (APTT) (unfractionated heparin monitoring)
  *(Recommended minimum volume = 2.7ml)*
- Coagulation Screen which includes:
  - Prothrombin time (PT)
  - Activated partial thromboplastin time (APTT)
  - Fibrinogen

  *(Recommended minimum volume = 2.7ml)*
- D-Dimer for VTE exclusion (NICE Guideline June 2023)
  *(Recommended minimum volume = 2.7ml)*

Warfarin Guidance can be accessed at
http://www.b-s-h.org.uk/guidelines/guidelines/oral-anticoagulation-with-warfarin-4th-edition/

Other clotting tests available are:

- Lupus Anticoagulant — 2 x blue top citrated specimen
  Specific Turnaround Time: 6 weeks*
  *(Recommended minimum volume = 2.7ml X 2)*
  Reporting range: Lupus anticoagulant screening test ≥ 1.2 – Lupus anticoagulant detected
- Anti Xa assay — 1 x blue top citrated specimen
  *(Recommended minimum volume = 2.7ml)*
- Thrombophilia screen which includes:
  - Antithrombin
  - Protein C
  - Protein S
  - Activated protein C resistance
  - Lupus anticoagulant

  — 3 x blue top citrated specimens *(Recommended minimum volume = 2.7ml X 3)*

  Specific Turnaround Time: 6 weeks*
  - Factor V Leiden gene mutation
  - Prothrombin 20210 gene mutation (referral/regional test)

  — 1 x purple top EDTA specimen *(Recommended minimum volume = 4ml)*

  Specific Turnaround Time: 8 weeks*
  - Anticardiolipin antibodies (referral/regional test) — 1 x yellow top clotted specimen *(Recommended minimum volume = 4ml)*

  Specific Turnaround Time: 1-2 weeks
  **Requests are batched for analysis*

*The Laboratory will not analyse thrombophilia screens unless **clinical details are supplied AND the patient is under 50 years old**. Exceptions to this age limit will be considered only after discussion with a Consultant Haematologist.*
*Factor V Leiden/Prothrombin 20210 gene mutation will only be accepted for testing if the patient has a positive APCR result.*

- Platelet aggregation (referral/regional test) — 5 x blue top citrated specimens
  *(Recommended minimum volume = 2.7ml X 5)*
  **Contact the Laboratory to arrange a date for sample collection** – these samples need to be taken first thing in the morning and sent to the Laboratory immediately (requires testing by the regional Laboratory within 4 hours)
  Specific Turnaround Time: 1-2 days

- Specific coagulation factor assays — 2 x blue top citrated specimens
  *(Recommended minimum volume = 2.7ml X 2)*
  Specific Turnaround Time: 1 week (when required urgently contact Coagulation)

- HIT assay (referral/regional test) — 1 x yellow top specimen
  **Requires approval from a Consultant Haematologist prior to ordering**
  *(Recommended minimum volume = 4ml)*
  Specific Turnaround Time: 1-2 weeks

- Platelet Function (PFA-100) (referral/regional test) — 2 x blue top citrated specimens
  *(Recommended minimum volume = 2.7ml X 2)*
  **Contact the Laboratory to arrange a date for sample collection** – these samples need to be taken first thing in the morning and sent to the Laboratory immediately (requires testing by the regional Laboratory within 4 hours)
  Specific Turnaround Time: 1-2 day

- Von Willebrand Antigen & Activity (referral/regional test) — 2 x blue top citrated specimens
  *(Recommended minimum volume = 2.7ml X 2)*
  Specific Turnaround Time: 3-4 weeks

**Adult Reference Intervals**

| TEST | REFERENCE INTERVAL |
|---|---|
| Prothrombin time | 10.1 – 14.3 seconds |
| APTT | 21 – 32 seconds |
| Fibrinogen | 1.8 – 4.3 g/l |
| INR | For Warfarin treatment, target varies |
| D-Dimer | For VTE exclusion, result below Lab cut off<br>(Reference Interval on report – for details contact the Laboratory) |
| Anti-Xa | Prophylaxis: 0.2 – 0.4 IU/ml<br>Treatment: 0.5 – 1.0 IU/ml |

**Paediatric Reference Intervals**

To minimise iatrogenic blood loss, small volume paediatric tubes (1 blue topped sodium citrate tube filled to 1.3 ml mark) are available for Coagulation Studies. Normal Coagulation Parameters from birth to 6 months are shown below:

| TEST (Unit) | REFERENCE INTERVAL | | | |
|---|---|---|---|---|
| | UP TO 1 DAY | UP TO 1 MONTH | UP TO 3 MONTHS | UP TO 6 MONTHS |
| Prothrombin time (secs) | 10.1 - 15.9 | 10.0 - 14.2 | 10.0 - 14.2 | 10.7 - 13.9 |
| APTT (seconds) | 31.3 - 54.5 | 32.0 - 55.2 | 29.0 - 50.1 | 28.1 - 42.9 |
| Fibrinogen (g/l) | 1.67 - 3.99 | 1.62 - 3.78 | 1.50 - 3.79 | 1.50 - 3.87 |

*Sources of reference intervals are available from the Laboratory.*

# BLOOD TRANSFUSION

**Addressograph labels may be used on request forms, and specimen tubes must be hand written, unless ordered via EPIC, where a printed EPIC label is acceptable. The request form must be signed for all requests, however the specimen tube only needs to be signed if the specimen tube does not have an EPIC label or if samples are requested for antibody investigation at NIBTS, then the sample must be dated, timed and signed.**

A Blood Bank request form, complete with clinical details and full patient identification information, must accompany all specimens sent to the Blood Bank as per Trust Blood Transfusion Policy

All specimens sent for blood grouping or cross matching will be held in the Laboratory for 7 days.
**Note: Minimum 4mls of blood specimen is required**

When requesting blood products it is vital to state the urgency with which those products are required, for example distinguish between next day routine operation, same day use or immediate use (refer to maximum surgical blood ordering schedule).

**Emergency O negative – 4 units** available **immediately** for collection from Blood Bank

**Uncrossmatched Group Specific blood** is available in **10 minutes** after receipt of request by the Blood Bank. *This is dependent on the presence of a valid specimen in the Blood Bank already tested with no atypical antibodies.*

**Crossmatched blood** is available **approximately 1 hour** after receipt of request by the Blood Bank. *This is dependent on the presence of a valid specimen in the Blood Bank already tested with no atypical antibodies.*

Most requests will be dealt with on the same day; however requests for Blood with specific Special Requirements may require additional time for processing, for example:

- Irradiated blood – up to 4 hours
- HLA matched blood – can be up to 5-7 days (contact Blood Bank for further advice)
- Warm autoagglutinins – approximately 48 hours
- Antigen negative units for multiple antibodies –up to 4-5 hours

These times should be used as guide only and if blood with specific requirements is required the Blood Bank should be notified in advance.

## Specimens Required for Blood Transfusion and Turnaround Times

| TEST | CONTAINER | ROUTINE TURNAROUND TIME |
|---|---|---|
| Antenatal Group and Antibody Screen | 1 x pink topped EDTA crossmatch specimen container | 3 working days* |
| Antibody Investigations | 2 x pink topped EDTA crossmatch specimen container | 4 working days* |
| Blood Group and Antibody Screen | 1 x pink topped EDTA crossmatch specimen container | 1 working day |
| Cord Blood for Group and Direct Coombs | 1 x pink topped EDTA crossmatch specimen container | 1 working day |
| Crossmatching | 1 x pink topped EDTA crossmatch specimen container | 1 working day |
| Direct Coombs Test | 1 x pink topped specimen container | 1 working day |

| TEST | CONTAINER | ROUTINE TURNAROUND TIME |
|---|---|---|
| Kleihauer Test | 1 x purple topped specimen container | 1 working day |
| Paediatric (<4 months old) Group and Direct Coombs | 1 x pink or purple topped paed. specimen container | 1 working day |
| Rubella Screening | 1 x 6ml purple topped EDTA specimen container | 4 working days* |

*****_Turnaround time dependant on Regional Laboratory – Northern Ireland Blood Transfusion Service_
_Note: Adult blood group, antibody screen and cross match blood specimen is required for all children over 4 months old._

**Guidelines for Blood Transfusion Practice**

All those who are involved in the transfusion process (sampling, prescribing, administration etc.) should be familiar with the current guidelines on safe transfusion practice. The Ulster Hospital Haemovigilance team have a Blood Transfusion page on iConnect (A – Z of Services → B → Blood Transfusion), which provides a resource for Trust staff to access transfusion guidelines.

**Transfusion Reactions**

If it is suspected that deterioration in the condition of a patient is related to transfusion of any blood product, please contact the Hospital Blood Bank **without delay** to arrange investigation. A Suspected Transfusion Reaction Report must also be completed and sent to the Hospital Transfusion laboratory. The following specimens will be required to investigate a suspected transfusion reaction:

- The blood packs involved
- Blood specimen: 2 x pink topped EDTA crossmatch tube.
- 10 mls urine in a universal container
- 1 x yellow topped SST specimen container for urea and electrolyte and liver function tests.

***Complete a CA/PA and record on Datix Web (DIF1).***

***All serious hazards of blood transfusion are the subject of a national anonymised reporting system (SABRE/SHOT)***

The Handbook of Transfusion Medicine and the SEHSCT Blood Transfusion Policy contain more detailed information about serious transfusion reactions. Please report all suspected transfusion reactions to Ulster Hospital Blood Bank staff.

**Maximum Surgical Blood Ordering Tariff**

The following are suggested blood ordering tariffs for surgery in patients who have adequate pre-operative Haemoglobin. Anaemic patients may require pre-operative transfusion or additional blood cross-matched prior to surgery. In addition, if the Consultant in charge feels that in certain cases heavy blood loss might be expected, they may order blood prior to surgery.
*Note: G&S = group and screen, and Number = units cross-matched.*

## General Surgery

| | |
|---|---|
| • Cholecystectomy and exploration of common duct | G&S |
| • Splenectomy | G&S |
| • Laparotomy | G&S |
| • Liver biopsy | G&S |
| • Gastrostomy, ileostomy, colostomy | G&S |
| • Oesophageal dilation | G&S |
| • Oesophagectomy | 2 |
| • Hiatus hernia | G&S |
| • Partial gastrectomy | G&S |
| • Oesophagogastrectomy | 2 |
| • Hepatectomy | 4 |
| • Mastectomy (simple) | G&S |

## Endocrine

| | |
|---|---|
| • Thyroidectomy - partial/total | G&S |
| • Parathyroidectomy | G&S |
| • Adrenalectomy | 3 |
| • Pancreatectomy-partial / Whipple | 4 |

## Colorectal Surgery

| | |
|---|---|
| • Rectum-pouch; resection/excision etc. | 2 |
| • Antero-perineal resection | 2 |
| • Intra-abdominal colectomy etc. | 2 |
| • Rectoplexy | G&S |

## Orthopaedics

| | |
|---|---|
| • Removal hip pin or femoral nail | G&S |
| • Nailing fractured neck of femur | G&S |
| • Hemiarthroplasty | 2 |
| • Internal fixation of femur | G&S |
| • Internal fixation-tibia or ankle | G&S |
| • Arthroplasty-total knee or shoulder | G&S |
| • Changing hip prosthesis | 2 |
| • Dynamic hip screw | 2 |
| • Osteotomy/bone biopsy (except upper femur) | G&S |
| • Bone graft from iliac crest-1 side (both sides) | G&S |

## Urology

| | |
|---|---|
| • Cystectomy | 4 |
| • Nephrectomy | 2 |
| • Nephrectomy and exploration of Vena Cava | 6 |
| • Open Prostatectomy | 2 |
| • TURP | G&S |
| • TUR bladder tumour | G&S |
| • Cystotomy | G&S |
| • Reimplantation of ureter | G&S |
| • Urethroplasty | 2 |

## Endoscopy

| | |
|---|---|
| • ERCP | G&S |

## Plastic Surgery

| | |
|---|---|
| • Major head and neck dissection & reconstruction | G&S |
| • Other head and neck procedure | G&S |
| • Abdominoplasty | G&S |
| • Mammoplasty | G&S |
| • Breast reduction | G&S |
| • Tram Flap | 2 |

## Obstetrics and Gynaecology

| | |
|---|---|
| • LSCS (High Risk) | G&S |
| • ERPC | G&S |
| • Hydatiform mole | G&S |
| • Placenta praevia | 2 |
| • Retained Placenta | G&S |
| • APH/PPH | G&S |
| • Hysterectomy: abdominal or vaginal | G&S |
| • Operative Laparotomy | G&S |

**Blood Products Available from Blood Bank**

The following table provides a guide to the products available from the hospital Blood Bank, along with a brief summary of their respective characteristics and clinical use.

The use of the following products must be discussed with a Consultant Haematologist.

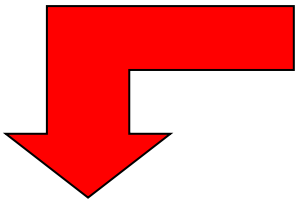
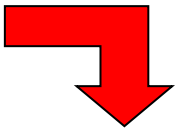
- Coagulation factor replacement products

**Traceability** (refer to Trust Traceability of Blood and Blood Products Policy on iConnect)

Traceability forms are required for:
Red Cells
Fresh frozen plasma
Cryoprecipitate
Platelet concentrate

**Product Characteristics and Use**

| PRODUCT | CHARACTERISTICS AND USE |
|---|---|
| Cryoprecipitate | Pooled, product from five donors (Adult therapeutic dose 2 packs)<br>Shelf life 3 years (frozen) at ≤-25ºC<br>Once thawed infusion must be completed within 4 hours<br>Product contains Factor VIII > 350 iu. Fibrinogen > 700 mg<br>Source of Fibrinogen |
| Fresh Frozen Plasma | Shelf life 3 years (frozen) at ≤-25ºC<br>Once thawed infusion must be completed within 24 hours<br>Should be ABO compatible<br>Used for specific indications only:<br>1. Replacement of coagulation factors where a specific or combined factor concentrate is unavailable<br>2. DIC (Disseminated Intravascular coagulation)<br>3. TTP (Thrombotic thrombocytopenic purpura)<br>4. In severe bleeding for reversal of Warfarin where activated factors are unavailable<br>5. Disturbed coagulation in massive transfusion, liver failure, CABG, surgery and some paediatric indications |
| Human Albumin 5% solution | Issued in 500ml bottle<br>Stored between 2-25ºC<br>This product is requested on Blood Transfusion Request form and is issued with similar documentation to all other blood components. |
| Human Albumin 20% Solution | Issued in 50/100ml bottles<br>This product is requested on Blood Transfusion Request form and is issued with similar documentation to all other blood components<br>Stored between 2-25ºC<br>Mostly used in hypoproteinaemia<br>Specific requests for 50ml bottles require advance notice to allow the product to be ordered from NIBTS.<br>***Please return any unused bottles immediately to Blood Bank – DO NOT STORE ON WARD*** |
| Platelet Concentrate | Shelf life 5 / 7 days when stored on a platelet agitator at 22ºC ±2 ºC<br>Should be infused immediately after removal from controlled storage |

| PRODUCT | CHARACTERISTICS AND USE |
|---|---|
| Prothrombin Complex Concentrate | For rapid reversal of Warfarin<br><br>Trust Guidelines:<br>Guidelines for the rapid reversal of warfarin coagulopathy in patients with life threatening haemorrhage and intracranial haemorrhage<br><br><br>(a) Intracranial bleed<br>(b) Retroperitoneal bleed<br>(c) Intra-ocular bleed<br>(d) Muscle bleed with compartment syndrome<br>(e) Pericardial<br>(f) Active bleed with hypotension or 20g/l fall in Hb<br><br>**Contact Haematologist ASAP**<br>PCC (octaplex) 30iu/kg – INR > 4<br>PCC (octaplex) 15iu/kg – INR < 4<br>Vitamin K 5mg IV<br><br>Check INR and APTT post infusion and at 4 hours<br>If INR >1.5, discuss with Haematology Laboratory<br><br>PCC is relatively contra-indicated in DIC, acute liver failure and thrombosis. |
| Red Cells | Storage temperature 2 to 6$^{o}$C<br>Shelf life 35 days<br>Longest time from leaving controlled storage temperature to completing infusion 4 hours<br>Must be compatible with recipients ABO and Rh(D) type<br>O Rh(D) negative available for specific emergency situations<br>CMV negative available for specific indications<br>Irradiated red cells available for specific indications |

*For all other products, call Blood Bank, Ext 21506.*

# MICROBIOLOGY

*A UKAS accredited medical laboratory No. 8029*

*The laboratory's full schedule of accreditation, listing accredited tests, can be found on the UKAS website. Any tests not on the schedule are highlighted throughout this section.*

## MICROBIOLOGY CONTACT DETAILS

| | |
|---|---|
| **CONSULTANT HEAD OF MICROBIOLOGY:** | Dr. Will Beynon<br>will.beynon@setrust.hscni.net |
| **CONSULTANT MICROBIOLOGIST / INFECTION CONTROL DOCTOR:** | Dr. Yuri Protaschik<br>yuri.protaschik@setrust.hscni.net |
| **CONSULTANT MICROBIOLOGIST:** | Dr. Aaron Nagar<br>aaron.nagar@setrust.hscni.net |
| **CONSULTANT MICROBIOLOGIST:** | *Vacant*<br>*forename.surname@setrust.hscni.net* |
| **CONSULTANT MICROBIOLOGIST:** | *Vacant*<br>*forename.surname@setrust.hscni.net* |
| **MICROBIOLOGY SPECIALTY DOCTOR:** | Dr. Hannah Stevens<br>hannah.stevens@setrust.hscni.net |
| **MICROBIOLOGY HEAD BIOMEDICAL SCIENTIST:** | Ryan Graydon<br>028 9041 1575 / Ext 22544<br>ryan.graydon@setrust.hscni.net |
| **INFECTION PREVENTION AND CONTROL CLINICAL MANAGER:** | Jillian Stevenson<br>028 9041 1570<br>jillian.stevenson@setrust.hscni.net |
| **GENERAL ENQUIRIES:** | 028 9041 1701 / Ext. 21554 |
| **MICROBIOLOGY:** | 028 9041 1526 / Ext. 21514 |
| **ON-CALL BIOMEDICAL SCIENTIST:** | 028 9048 4511 *(Request 'On-Call Microbiology BMS')* |

# SPECIMEN COLLECTION

## General information

Please provide clinical details to aid Laboratory testing, i.e. current antibiotics.

The prompt and accurate isolation of infecting agents is directly influenced by the quality of the specimen. With the exception of suspected meningitis it is almost always possible to obtain appropriate specimens before commencing antibiotic therapy.

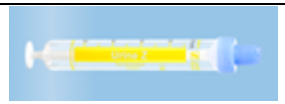
The following points should be adhered to:

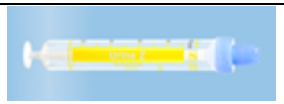
- Collect specimen before administration of antibiotic therapy
- Specimen should be transported to the laboratory **as soon as possible**
- Ensure that the specimen container is clearly labelled with the patient's details
- Remember that you may be dealing with pathogenic microorganisms and care should be taken while obtaining and handling the specimen (see Infection Control Guidelines)

| TEST/SPECIMEN | CONTAINER | | | MINIMUM VOLUME (Dependent on tests required) | TAT |
|---|---|---|---|---|---|
| Blood Culture | Adult: | Aerobic FA Plus |  | **Max fill** = 10mL | Up to 7 days<br><br>*Positive culture results will be telephoned to the ward* |
| | | Anaerobic FN Plus |  | **Max fill** = 10mL | |
| | Paediatric/ when only small vol. of blood obtainable | Pedi-Bact PFA plus<br><br>**Aerobic culture only** |  | **Max fill** = 4mL | |

| TEST/SPECIMEN | | CONTAINER | | MINIMUM VOLUME (Dependent on tests required) | | | TAT |
|---|---|---|---|---|---|---|---|
| Urgent COVID (SARS-CoV-2)/Flu/RSV PCR | Combined nasal and throat dry swab | Sterile white top universal container |  | N/A | | | 90 mins |
| CSF **(Routine culture/ Gram stain/ Cell count)** **For test protocol and virology test requirements see COLLECTION OF SPECIFIC SPECIMEN TYPES** | | Sterile white top universal container |  | **2 x 1mL** | **Gram Stain/Cell Count** | | 1hr |
| | | | | | **Prelim culture Report** | | 2 days |
| | | | | | **Final report** | | 3 days |
| Enteric pathogens **(FPCR/Routine culture/ *C. difficile*/ Parasitology)** **For parasitology sample requirements see COLLECTION OF SPECIFIC SPECIMEN TYPES** | Faeces | Blue topped universal container with plastic spoon |  | **PCR** | | 1-2mL *(Only 1 sample required)* | 2 days |
| | | | | **Routine culture** | | | 3 days |
| | | | | ***C. difficile*** | | 5mL | 1 day |
| | | | | **Parasitology** | | **3 x 5mL** | 7 days |
| Fluids (Sterile) **(Routine culture/Gram stain/Crystal analysis/Cell count)** | Amniotic fluid<br>Bursa fluid<br>Pericardial fluid<br>Synovial (joint) fluid<br>Peritoneal fluid (ascites)<br>Pleural fluid | Sterile white topped universal container |  | **Routine culture/Gram stain** | | 1mL | 4 - 7 days |
| | | Sterile white topped universal container |  | **Crystal analysis/?gout (with separate request form)** | | 1mL | 8 days |
| | | Purple top EDTA (prevents clotting) |  | **Cell count** | | Minimum mark on bottle | 2 hours |
| Fluids (Non-sterile) **(Routine culture/Gram stain)** | Pus (inflammatory exudates) | Sterile white topped universal container |  | 1mL | | | 4 – 7 days |
| Helicobacter pylori faecal antigen | Faeces | Blue topped universal container with plastic spoon |  | 2mL | | | 2 weeks |
| Intra Uterine Contraceptive Device (IUCD) | | Wide neck sterile CE marked leak proof container | | N/A | | | 2 weeks |

| TEST/SPECIMEN | | CONTAINER | | MINIMUM VOLUME (Dependent on tests required) | TAT |
|---|---|---|---|---|---|
| Norovirus<br>**Test requires approval by INFECTION CONTROL prior to sending to Lab** | Faeces | Blue topped universal container with plastic spoon |  | 1-2mL | 3 hours |
| Post Vasectomy Semen Analysis<br>*(Not UKAS accredited)*<br>**For test protocol see COLLECTION OF SPECIFIC SPECIMEN TYPES** | Semen<br>**Specimens accepted by appointment only.** | 125 ml Birr Semen Collection Container |  | Complete ejaculate | 1 – 2 days |
| Respiratory pathogens<br>**(Routine Culture)** | Sputum<br>Bronchial Lavage<br>Bronchial washings | Wide neck sterile CE marked leak proof container |  | 1mL | 2 – 3 days |
| Swabs*<br>**(Routine Culture/Gram stain)**<br>** Automated inoculation for culture using the Walk Away Sample Processor (WASP) not UKAS accredited – awaiting completion of an Extension to Scope (ETS)* | Copan ESwab® - Various sites | <br>***Do not discard Liquid from Copan ESwab container*** | | N/A | 2 – 3 days |
| **(Isolation and identification of Trichomonas vaginalis)**<br>*(Not UKAS accredited)* | Trichomonas Broth |  | | | 4 – 5 days |
| **(Microscopy for bacterial vaginosis)**<br>*(Not UKAS accredited)* | Copan ESwab® - Vaginal | <br>***Do not discard Liquid from Copan ESwab container*** | | | 2 – 3 days |

| TEST/SPECIMEN | | CONTAINER | | MINIMUM VOLUME (Dependent on tests required) | TAT |
|---|---|---|---|---|---|
| Screening **(CPO)**<br><br>**(Group B Streptococci)**<br><br>**(MRSA/MSSA)**<br><br>**(VRE/GRE)** | Faeces<br>Rectal swab<br>Wound swab<br>Urine (*CSU only*)<br><br>Recto vaginal swab<br>**For test protocol see COLLECTION OF SPECIFIC SPECIMEN TYPES**<br><br>**Standard screening sites:**<br>Nasal swab +<br>Groin/perineum swab<br>**When appropriate:**<br>Skin access site swab /<br>Wound swab / Urine / Sputum<br><br>Rectal swab<br>Faeces | **Faeces**<br>Blue topped universal container with plastic spoon |  | 1 -2 mL | 2 – 3 days |
| | | **Swabs**<br>Copan ESwab® |  | N/A | |
| | | ***Do not discard Liquid from Copan ESwab container*** | | | |
| | | **Urine**<br>Urine monovette® / |  | 1mL | |
| | | Urine monovette®<br>Boric acid |  | 10mL | |
| | | **Sputum**<br>Wide neck sterile CE marked leak proof container |  | 1mL | |
| | | **Faeces**<br>Blue topped universal container with plastic spoon |  | 1 -2 mL | |
| | | **Swabs**<br>Copan ESwab® |  | N/A | |
| | | ***Do not discard Liquid from Copan ESwab container*** | | | |
| Tissue / Bone / Biopsy **(Routine culture/Gram stain)** | | Sterile white top universal container |  | N/A | 5 – 10 days |

| TEST/SPECIMEN | | CONTAINER | | MINIMUM VOLUME (Dependent on tests required) | TAT |
|---|---|---|---|---|---|
| Urinary Antigen Testing **(Legionella & Pneumococcal)** | Urine **(Pneumococcal Urinary Antigen testing is only available for ICU/HDU patients)** | Sterile white top universal container |  | 1mL | 2 days |
| Urine **(Routine culture & Microscopy)** | | Urine monovette® **(Must be received within 4hrs or sample must be refrigerated and a comment of refrigeration recorded on request form)** |  | 1mL | 2 – 3 days |
| | | Urine monovette® Boric Acid |  | 10mL | |

If you are in any doubt about the most appropriate specimen or container, please contact the laboratory for advice (see contact details).
For test protocols see collection of specific specimen types.

**Turnaround Times**

These turnaround times are from receipt by the Laboratory to result availability. The Laboratory aims to process 95% of requests within these stated turnaround times, however the nature of microbiology investigations means that some results may take longer. Please also be aware that some turnaround times may be elongated by up to 2 days if specimens require work over the weekend.

**Result Reporting**

Final reports are issued as soon as possible. Telephone requests should be kept to a minimum in the interest of safety, as verbal reports may lead to transcription errors. Telephone calls for provisional culture results should be made after 11am.

**Note that antimicrobial testing and reporting is guided by European Committee on Antimicrobial Susceptibility Testing (EUCAST) recommendations. To aid antimicrobial stewardship, a limited panel of antibiotics are reported for each organism, in a regionally agreed format. If a patient is on a specific antibiotic, please detail it on the request.**

**Note that antifungal susceptibility testing is carried out via manual microtitration and is not UKAS accredited.**

**Urgent requests**

Only certain tests are available as urgent requests. The tests in Microbiology that are available as urgent requests are shown below.

| MICROBIOLOGY TESTS AVAILABLE AS URGENT REQUESTS |
|---|
| CSF examination (Gram stain, cell count & culture) |
| Gram stain & culture of pus or body fluid from normally sterile sites |
| Urine microscopy |
| Covid/Flu/RSV (Must meet criteria on urgent Encompass order form) |
| Immediate plating and processing of urgent specimens including those where the culture is required for the next working day and where the clinical management could be altered by results. |

**If the request is of an urgent nature, please place the request in a blue Microbiology urgent specimen bag (Encompass orders) or indicate the urgency by writing 'URGENT' on the request form (manual orders). For both ordering methods telephone the Microbiology Laboratory, Ext 21514 (routine hours) or via Switchboard (out-of-hours), to make them aware of the request.**

**Infection Prevention & Control**

- Wash hands thoroughly using liquid soap and water. Use alcohol hand sanitizer (if hands are visibly clean) before obtaining the specimen and after it has been prepared for collection
- Gloves should always be worn when handling bodily fluids
- Do not overfill container
- Ensure container is securely closed and outside of container is not contaminated by the specimen
- Place the specimen in a polyethene bag for transport to the laboratory
  **Note:** Where the request form is not attached to a polyethene bag, e.g. Virology, a separate biohazard bag should be used (obtained from the laboratory).

**High Risk:** ***All specimens from suspected or proven cases of HIV, Hepatitis B and C, and Tuberculosis must be labelled with a special biohazard label "Danger of Infection - Take special care". These labels are available from the laboratory and should be attached to the specimen container and to both copies of the request form. For Needle stick injuries please refer to the SEHSCT Guidelines.***

# COLLECTION OF SPECIFIC SPECIMEN TYPES

## 1. Blood Cultures

These should form part of the investigation of every pyrexial illness. Specimens of blood should be taken as soon as possible after a "spike" of fever and, in almost all cases, should be performed **before** initiation of antibiotic therapy.

Ideally a minimum of 2 sets of blood cultures should be collected (preferably not less than 1 hour apart). A single blood culture set may miss intermittently occurring bacteraemia and make it difficult to interpret the clinical significance of certain isolated organisms.

*Endocarditis – bacteraemia is continuous in this condition so blood cultures do not have to be related to pyrexial episode. At least 3 sets of cultures should be collected and as the density of bacteraemia may be very low the maximum volume of blood should be inoculated into the culture bottles – see below.*

Blood culture bottles can be ordered using the weekly lab order form. These bottles have a limited shelf life and should not be stored in large quantities at ward level. Blood culture bottles are also available from the lobby at Specimen Reception.

| Blood Culture Bottles | |
|---|---|
| **Aerobic FA Plus** | Pale green colour code top, recommended maximum fill 10ml blood. Contains polymer beads that can help to absorb antibiotics. |
| **Pedi-Bact PFA plus aerobic** | Yellow colour code top, recommended maximum fill 4ml blood. This bottle is for aerobic culture only and normally to be used with babies or infants, or only in an extreme case where only small volumes of blood are obtainable. A comment will recorded on the report when one is received for an adult as only organisms capable of aerobic growth will be detected. Contains polymer beads that can help to absorb antibiotics. |
| **Anaerobic FN Plus** | Orange colour code top, recommended maximum fill 10ml blood. Contains polymer beads that can help to absorb antibiotics. |

**Note: Blood for mycobacterial culture requires a dedicated blood culture bottle. These Bactec Myco F culture bottles are available on request from Microbiology. These samples must not be transported in via the pneumatic tube system.**

Procedure: Main principles

1. Wash and dry your hands before commencing procedure and at correct times during the procedure.

2. Inspect the venepuncture site, wash with soap and water if visibly soiled and palpate the vein. Carefully clean the venepuncture area with 2% chlorhexidine in 70% alcohol wipes. ALLOW TO DRY. Use povidone iodine in alcohol if there is allergy to chlorhexidine

3. Do not re-palpate the vein after skin disinfection. Consider using sterile gloves if this cannot be avoided.

4. Inspect broth and the sensor located on the bottom of each bottle. Ensure that the broth is straw-coloured and transparent, for aerobic and anaerobic bottles, and that the sensor is intact and a blue-green colour. Remove the centre plastic flip top lids from the BacT/Alert bottles and disinfect the exposed rubber diaphragms with disinfectant wipes and allow to dry.

5. Take the specimen of blood and inoculate recommended volume.

6. Refer to Trust guidelines below, which are available on i-connect:
   - Blood Culture Taking / Collection Guidelines Neonates, Children and Young People (SET/ Guide (19) 2021)
   - Blood Culture Taking / Collection Guidelines Adult Patients (SET/ Guide (06) 2022)

*If blood has been obtained for other purposes it is essential to inoculate the blood culture bottle first to avoid cross contamination from non-sterile specimen containers. Inoculate the anaerobic bottle first.*

7. Dispose of all sharps and blood sampling devices directly to a sharps waste container at the point of use - DO NOT RESHEATH.

8. Label each bottle separately with patient's name, his/her hospital ID, ward, date and time of collection. If two sets of blood cultures are taken at the same time from a central line and a peripheral site please mark the site sampled on all 4 bottles. ***NOTE: If paper labels are used, stick on bottom half of the bottle not over the Bar Code as this is needed for bottle identification. DO NOT REMOVE THE BARCODE STRIPS FROM THE BOTTLE. If patient ID labels with a barcode are used, the barcode must be placed on vertically and you must ensure that the bottle barcode is not obscured.***



Blood cultures must be transported to the Laboratory specimen reception immediately.

Reporting

The Ward will be informed immediately if any blood culture is found positive and a gram stain result will be provided. Identification and sensitivity test results will follow in a final report. If in any doubt about the most appropriate antibiotic agent seek advice from the Medical Microbiologist.

**2. Cerebrospinal fluid (CSF)**

CSF investigations are usually multidisciplinary so in order to ensure the precious specimens are handled correctly please complete a **SETRUST LUMBAR PUNCTURE PROCEDURAL PROFORMA** and follow the instructions on **Sample Handling**:

Please label samples in order of draw (**SEND IN A SEALED BROWN ENVELOPE**). **INFORM BIOCHEMISTRY AND MICROBIOLOGY LABORATORIES THAT SAMPLES ARE BEING SENT**. Remember to send **paired plasma** samples

- Samples 1 & 2 (in sterile plastic universal containers) must be sent with a Microbiology form – cell counts, gram stain and culture

- Sample 3 (in a sterile plastic universal container) must be sent with an Urgent Biochemistry form – protein / glucose / spectrophotometry for Xanthochromia if required
- Sample 4 (in a sterile plastic universal container) must be sent with a Virology form if required for PCR (i.e. viral aetiology suspected) – *An additional throat swab in a transport medium (UTM, eNat medium or lysis buffer) plus a faeces specimen must be sent*
- Other, e.g. Cytology / Immunology (please state)
- Paired samples (**yellow top** blood specimen) sent for glucose / protein / bilirubin must be sent with an Urgent Biochemistry form
- Paired samples (**yellow top** blood specimen) sent for oligoclonal bands (RVH Clinical Chemistry), if required, must be sent with a BHSCT Clinical Chemistry form or an SET External Referral request form

**All CSF specimens must be delivered by hand, without delay, to the Microbiology laboratory**

**The clinical reason for the request must be written on the request forms** along with the **result of the CT scan**, the **time of onset of symptoms/event**, the **time of lumbar puncture** and **if the differential diagnosis includes meningitis**.

Also, please include any antimicrobial or antiviral treatment in the clinical details section of the request form.

Additional tests:

- Examination for tubercle bacilli is only undertaken if indicated by cell count/protein level/sugar level profile or on request
- If amino acids are requested 1 additional plastic universal container with CSF and 1 additional purple top blood specimen must be taken and a BHSCT Clinical Chemistry/External Referral request form completed
- If cytospin is requested (for suspected malignant infiltrate) then 1 additional plastic universal container with CSF must be taken and an urgent Haematology request form completed – this sample will be forwarded to BHSCT Haematology (Haemato-oncology)

***Note: For CSF 14-3-3 analysis (CJD) see the BHSCT Laboratories User Manual*** **https://belfasttrust.hscni.net/service/laboratory-services/**

**3. Eye swab**

Purulent material should be collected from behind the lower eye-lid or from the inner canthus. If neonatal gonococcal conjunctivitis is suspected transport the specimen to the Lab as quickly as possible. For suspected **Chlamydial conjunctivitis**, wipe away any muco-purulent material and swab the affected eye(s) using the swab provided in the Chlamydia specimen kit. Send to the Lab with a completed **Chlamydia PCR testing form** for each patient.

**4. Faeces**

Stools may be collected in a clean bedpan and must not be contaminated with urine or residual disinfectant. Collect a portion into a sterile faeces container using the spoon attached to the lid. Include material containing pus/mucus/blood if present. A minimum volume of 5ml required for *Clostridium difficile* testing.

***Note: In keeping with National guidelines, only diarrhoeal specimens will be tested for C.difficile toxins. Formed stool will not be tested.***

PCR for the following enteric pathogens is undertaken routinely - Salmonella enterica spp., Shigella spp./Enteroinvasive E. coli, Campylobacter jejuni/coli/lari, Cryptosporidium parvum/ hominis, Giardia lamblia and the VTEC gene. Additional examination for *Clostridium difficil*e or examination for unusual pathogens will be performed on clinical request or patient's history. Samples requesting

parasitology will be screened routinely for Cryptosporidium sp. and Giardia sp. by PCR. If extended parasitology microscopy is required specific foreign travel details must be stated on the request form **(Send three samples collected over sequential days, sending each sample as it is collected).**

Specimens for H. pylori faecal antigen testing should be refrigerated after collection (between 2° and 8°C) prior to transporting to the laboratory and must be received by the Laboratory within 48 hours of production. Prior to sampling patients should not have taken:

- any antibiotics for at least four weeks
- a proton pump inhibitor (PPI)
- H2-receptor antagonist medicine for at least two weeks.

Where a ward outbreak of gastrointestinal illness is suspected please contact the Infection Prevention & Control Department (Ext 21538). Out of hours contact the Microbiologist on call via switchboard. If food poisoning is suspected remember this is a notifiable illness and should be reported to the Public Health Agency.

For thread worm ova, a cotton wool swab in a dry container is required. This should be pre-moistened and applied to the peri-anal skin area. This is best done late at night or in the early morning before bathing. Specimens should be transported and examined as soon as possible.

**Outbreak of vomiting and/or diarrhoea: See appendix A*

**5. Genital Tract**

High vaginal swabs: swabs should be taken using a speculum as contaminating material from the lower vagina may affect results. NOTE CLINICAL DETAILS ON THE FORM ARE ESSENTIAL FOR CORRECT PROCESSING.

**Gonococci:* Swabs should be obtained from the endocervix, urethra and rectum from female patients and from the urethra and rectum in male patients. Direct microscopy for *N. gonorrhoeae* in the female urethra is of limited value but a smear from specimens from the male urethra should be prepared. **Request forms should specify culture for Gonococcus.**

** Chlamydia trachomatis: (molecular nucleic acid amplification test – NAT). Chlamydia collection kit available from the Lab store (Ext 21553).*

Suitable specimens:

1. Urine (male and female) *or*
2. Endocervical, vaginal and male urethral swabs.

For sample collection guidelines please refer to the Belfast Trust Laboratory User Manual – https://belfasttrust.hscni.net/service/laboratory-services/

**6. Bacterial vaginosis *(Not UKAS accredited)***

*Gardnerella vaginalis*:- Screening for B. vaginosis is carried out by microscopy on all pregnant women. The testing of other women is dependent on relevant clinical details.

**7. Trichomonas vaginalis *(Not UKAS accredited)***

In cases of suspected Trichomonas vaginalis or STI:- A high vaginal swab should be sent in specific trichomonas transport medium. Allow transport medium to come to room temperature before use.

** Consider referral to Genito Urinary Medicine*

**8. Intravenous Catheter Tip**

Clean insertion site with a 2% chlorhexidine in 70% alcohol wipe (unless contraindicated, e.g. allergy) and allow to dry. Aseptically remove catheter and send a maximum of a 5cm tip to laboratory in sterile universal container. If there is purulent material at the exit site please swab the exudate in advance of disinfection (of the site) and removal of the catheter and send for culture.

**9. Nose and Throat Swab**

Throat swab: (e.g. for Group A streptococci) Rub a sterile swab over tonsillar areas, posterior pharyngeal wall and any areas of ulceration, exudation or membrane formation. *NB If diphtheria is considered as a diagnosis, please state this clearly on the request form.*

**10. Pus / Inflammatory Exudates / Fluids**

If there is any volume of pus present **please do not send a swab.** Aspirate the pus/exudate/fluid with a sterile syringe and transfer to a sterile universal container. If there is only a very small volume of material in the syringe, add some sterile preservative-free saline, mix and transfer to the sterile container. The site of origin of the material must be clearly stated. Send to the laboratory immediately. Out-of-hours, please notify on-call Biomedical Scientist of any urgent specimens.

**11. Post Vasectomy Semen Analysis *(Not UKAS accredited)***

**The form must be fully completed by medical staff before giving to the patient. Comprehensive instructions are provided with the form.**

Specimens should be tested at 12 weeks post vasectomy after at least 20 ejaculations. If sperm are still present, another specimen 6 weeks later, after a further 12 ejaculations is requested. Specimens should be collected as above and brought directly to the laboratory specimen reception (9am – 1pm Monday to Friday excluding bank holidays).

**Any requests for fertility testing should be made through the Regional Fertility Centre at the Royal Victoria Hospital, Belfast. Referral forms are available to clinicians by contacting 028 906 35888 (option 1). Further information is available at: https://belfasttrust.hscni.net/services/rfc/for-clinicians/infertility-referral/**

**12. Sputum / Bronchial Lavage / Bronchial Washings**

All patients treated for lower respiratory tract infection should have a sputum specimen sent for culture prior to commencing antibiotics. Patients should be asked to rinse out their mouths (using tap water only – if TB is suspected, use sterile preservative free water) and provide only material resulting from a deep cough. Physiotherapy assistance may be helpful if a patient has difficulty producing a suitable specimen (salivary specimens are unsuitable and may be rejected). Specimens should be sent to the Laboratory without delay.

Separate samples should be sent for O&S, Fungal culture or TB as required – state clearly on the request form which test you require.

**13. Urine**

Mid stream specimens are collected and decanted into either a boric acid urine container or, for small volume specimens, blue urine monovette® containers as follows:

Male: The glans penis is cleaned with soap and water. Micturition is commenced and after a few mls of urine have been passed, without stopping, allow urine to pass into a sterile foil dish. Transfer into a sterile urine container.

Female: Separate the labia and clean the vulva from front to back with cotton wool moistened with sterile water. With the labia separated micturition is commenced and after a few mls have been passed, without stopping, allow urine to pass into a sterile foil dish. Transfer into a sterile urine container.

Urine is an excellent growth medium for microorganisms. It is important that if there is to be any delay in transporting the specimen to the laboratory, it should be refrigerated. Non-boric acid containers that are not received in the Laboratory within 4 hours, with no sign of refrigeration, will be rejected.

Catheterised patients: This should be disinfected with a 2% chlorhexidine in 70% alcohol wipe unless there is a history of allergy. Allow the port to dry prior to aspirating the specimen. Never obtain the specimen from the drainage bag.

Paediatric practice: Suprapubic aspirates are the best specimens for establishing the diagnosis of bacteriuria in infants and small children. Otherwise, clean catch specimens are preferable to a bag collection. If washing is required because the perineum is soiled, an initial soap and water wash followed by a rinse with clean water and careful drying is all that is required.

**14. Wound Swabs**

Surface wounds and sinuses are often colonised with environmental bacteria and superficial swabs may not reflect the cause of the infectious process. Wherever possible, pus from the base of the wound should be aspirated by syringe and transferred to a sterile container. Only when this is not possible should a swab be used. First remove superficial slough, then extend the tip of the swab deep into the wound taking care to avoid the skin margins. The wound site and nature must be clearly stated on the request form.

**15. MRSA Screen**

Samples should be collected according to the instructions given in the Trust Meticillin-resistant Staphylococcus aureus (MRSA) Screening & Decolonising Guidelines.

The two standard screening sites for MRSA are:

- Nostrils (one swab)
- Groin and/or perineum

The sites below should be included as appropriate:

- Urine - *if patient is catheterised*
- Skin access sites - *if an invasive device is present*
- Sputum - *if patient has a productive cough*
- Breaks in skin or wounds - *for example, leg ulcers*

**Please note: If for the additional sites there is insufficient evidence on the request form to justify screening the sample will be rejected.**

It is advisable to send swabs from infected sites for O&S. MRSA and other pathogens can both be identified when processed this way.

**16. Group B Streptococci**

Correct specimen type and method of collection:

- The distal vagina (vaginal introitus) and the rectum should be swabbed.

- A single swab from both sites of collection is rational (recto vaginal swab), but two separate swabs (low vaginal (LVS) and anorectal swabs) can be accepted and combined during processing.
- Because lower vaginal as opposed to cervical cultures are recommended, cultures should not be collected by speculum examination.
- Note: Maternal high vaginal swabs should not be collected as these have a lower sensitivity.
- Specimens should be transported for processing as soon as possible.

**17. COVID (SARS-CoV-2) / FLU / RSV PCR**

Flu testing will be performed as part of a combined Covid/Flu/RSV test. All routine COVID PCR requests will automatically be tested for SARS-CoV-2, Flu A and Flu B, while RSV testing will also be included for paediatric inpatient requests.

Urgent rapid COVID testing has a very limited capacity and consequently testing is restricted to specific reasons which are listed on the urgent Encompass order form. The categories are subject to change based on test availability.

Specimens can be stored at room temperature (15–30 °C) for up to 24 hours.

## THERAPEUTIC DRUG MONITORING

Plasma assays are required for certain antibiotic agents to ensure therapeutic but non-toxic levels are achieved.

***Please note that Clinical Biochemistry performs Therapeutic Drug Monitoring at the Ulster Hospital Laboratories, including Gentamicin, Teicoplanin and Vancomycin. Amikacin and Tobramycin requests are referred to BHSCT. Requests for any Therapeutic Drug Monitoring should be sent directly to the Ulster Hospital Clinical Biochemistry Laboratory.***

Please seek the advice of Medical Microbiologist for information and advice regarding the monitoring of antimicrobials.
***For further information, please consult the Adult Empirical Antimicrobial Therapy Guidelines for Inpatients, available on the SEHSCT iConnect.***

## REFERRALS

A limited number of virology tests are provided by this Laboratory by antigen detection and include:
- Rotavirus & Adenovirus – carried out routinely on faecal samples from children under the age of 5.
- Respiratory Syncytial Virus (RSV) – performed on nasopharyngeal swabs on children under the age of 5.
  *Please note: RSV should not be requested on anyone over the age of 5, as adult samples will be referred to the Belfast Trust for a Respiratory Viral Screen (RVS).*

Further Virology testing, Mycobacterium Tuberculosis (TB) and Mycology tests are carried out at regional reference Laboratories within Northern Ireland. Please refer to the Belfast Trust Laboratories User Manual for specimen details – https://belfasttrust.hscni.net/service/laboratory-services/

Chlamydia and Gonorrhoea (GC) PCR, as well as Joint Fluids for crystal analysis is also carried out in the Belfast Trust – https://belfasttrust.hscni.net/service/laboratory-services/

The following tests are commonly referred by the Ulster Hospital Microbiology Laboratory to mainland UK for confirmatory/further testing:

| Hospital | Test(s) |
|---|---|
| Public Health England, Bristol – Mycology | Antifungal Assays (Itraconazole) |
| | Antigens Serology (Aspergillus (Galactomannan), Beta-Glucan & Candida (mannan)) |
| | Yeast identification |
| Public Health England, London – Bacteriology Reference Department | Campylobacter typing |
| | Carbapenem Resistance |
| | Corynebacterium (diphtheria & ulcerans) |
| | E. Coli O157 typing |
| | Enterococcus typing & resistance |
| | Haemophilus identification & typing |
| | Legionella/ Pneumococcal Antigen |
| | Neisseria identification & resistance |
| | Salmonella typing |
| | Shigella typing |
| | Staph aureus (MRSA & MSSA) PVL testing only |
| | Staph aureus (MRSA & MSSA) typing & resistance |
| | Streptococcus identification & typing |
| | Vibrio identification & typing |
| | Yersinia identification |

Please contact the Ulster Hospital Microbiology Laboratory for details of other less common referral tests that are not available in the Belfast Trust Laboratories User Manual (https://belfasttrust.hscni.net/service/laboratory-services/) or listed above.

**SYNDROMIC TESTING GUIDE/**
**GUIDE TO MICROBIOLOGICAL INVESTIGATIONS**

The table below and overleaf is NOT a substitute for clinical decision-making and use of the consultant advisory service. It is merely a guide to the selection and repertoire of tests used in the preliminary assessment of a patient.

| SYNDROME | SPECIMEN / INVESTIGATION | COMMENTS |
|---|---|---|
| **SCREENING** | | |
| **CPE (Carbapenemase-producing *Enterobacteriaceae*)** | Refer to Control of Multi-resistant Gram-negative Bacteria including Carbapenemase-producing *Enterobacteriaceae* Guidelines on iConnect | Seek advice from Infection Prevention and Control team. |
| **MRSA** | Refer to *Staphylococcus aureus* (MRSA) Screening & Decolonising Guidelines on iConnect | |
| **NEONATAL** | Refer to Admission to the Neonatal Unit Guidelines on iConnect | |
| **DIAGNOSTIC** | | |
| **ACUTE SYSTEMIC SEPSIS** (cause unknown) | Blood cultures, urine, consider CSF, line tips etc. | Careful clinical assessment for the source should guide investigations |
| **NEUTROPAENIC SEPSIS** | Central (a culture from each lumen) and peripheral blood cultures.<br><br>Line tips if appropriate.<br><br>Send wound swabs/swab of pus if there is evidence of skin and soft tissue infection at central line exit site | If a pulmonary infiltrate is present see pneumonia in immunocompromised below. |

| SYNDROME | SPECIMEN / INVESTIGATION | COMMENTS |
|---|---|---|
| **FEBRILE RETURNED TRAVELLER** | Blood cultures, malarial film (EDTA to Haematology) if appropriate.<br><br>Additional tests may be suggested by ID or local Microbiologists. | Consider discussion with Microbiology and with the Regional Infectious Diseases Team based in Belfast Trust.<br><br>Patients returning within 21 days from VHF endemic regions should be managed as outlined in the policy document 'Ebola Preparation: - Plan for Presentation and Admission of Viral Haemorrhagic Fever (VHF)' available on iConnect.<br><br>Label samples **'high risk'** |
| **GENERALISED LYMPHADENOPATHY** | EDTA blood to Haematology Dept for blood film. If negative (and atypical lymphocytes present) consider viral serology (EBV, CMV IgM, Toxoplasma IgM). Consider HIV seroconversion. | Patients should be made aware of a test for HIV and informed how they will receive their result.<br><br>If HIV test is being undertaken - NB label samples 'high risk/danger of infection' |
| **MUMPS** | Send saliva in a sterile container or buccal/throat dry swab.<br><br>Recommended specimen type is a parotid duct or buccal membrane swab. | Mumps antibody testing to support the childhood immunization program is not generally advised. |
| **LYME DISEASE**<br><br>***Reference:***<br>***NICE guideline***<br>***Lyme Disease NG95***<br>***(April 2018)*** | Lyme disease (Borrelia burgdorferi) serology for IgM and IgG antibodies. Panel as appropriate for symptom duration on EPIC. | Please put on request form – ensure to include travel history, duration of symptoms and antibiotic history.<br><br>Discuss Consider discussion with Microbiology/Infectious Diseases. |

| SYNDROME | SPECIMEN / INVESTIGATION | COMMENTS |
|---|---|---|
| **TUBERCULOSIS** | Sputum x 3 for microscopy for AFB. Consider bronchial-alveolar washing, urine, aspirated fluid and pus, tissue, cerebrospinal fluid (CSF), bone marrow aspirate and gastric washings as appropriate.<br><br>Bactec Myco F culture bottles are available on request from SET Microbiology Laboratory for mycobacterial blood cultures or bone marrow aspirate, where indicated. | For full guidance on investigations for Tuberculosis, please refer to the **Belfast Health and Social Care Trust Laboratory manual –** https://belfasttrust.hscni.net/service/laboratory-services/<br><br>Seek advice from Infection Prevention and Control team<br><br>Clinicians sending sterile site samples (e.g. blood, bone marrow) for mycobacterial culture should include the following details on the laboratory request form where relevant:<br>• History of cardiac surgery OR<br>• Under investigation for possible disseminated Mycobacterium chimaera infection<br><br>A separate prepared slide of bone marrow should be sent if an auramine slide is required.<br><br>Information regarding Mycobacteria chimaera infection guidance is available from PHE – https://www.gov.uk/government/publications/mycobacterium-chimaera-infections-guidance-for-secondary-care |
| **CNS INFECTIONS** | | |
| **BRAIN ABSCESS** | Blood cultures, biopsy / pus if available. | |

| SYNDROME | SPECIMEN / INVESTIGATION | COMMENTS |
|---|---|---|
| **MENINGITIS** | Blood cultures, CSF (include virology if relevant), EDTA blood for *Meningococcal* PCR.<br><br>Consider HIV testing in unexplained lymphocytic meningitis. | Lumbar puncture should not be performed if there is evidence of raised intracranial pressure.<br><br>Inform Public Health Agency via the Duty Room, 0300 555 0119, or out of hours via pha.dutyroom@hscni.net immediately for probable/confirmed meningococcal meningitis. They will arrange prophylaxis of contacts. |
| **ENCEPHALITIS** | CSF including viral PCR.<br>Blood serology for storage. | Consider discussion with Infectious Diseases if history of recent foreign travel if there is a history of foreign travel. |
| **IMMUNOSUPPRESSED** (meningitis /encephalitis /encephalopathy) | Blood culture, CSF for *Cryptococcus* (India Ink stain, culture and antigen test), other fungi, TB, bacterial culture, blood serology for storage, Cryptococcal antigen and other relevant serology. CSF for virology PCR (consider Toxoplasma, JC viruses, CMV PCR, EBV). | Consider discussion with Microbiology, ideally prior to lumbar puncture |
| **PROGRESSIVE MULTIFOCAL LEUCOENCEPHALOPATHY (PML)** | CSF for JC virus PCR, blood for serology. | |
| **HTLV-1-ASSOCIATED MYELOPATHY** | Blood for serology. | |
| **GUILLAIN BARRE SYNDROME** | CSF for CMV PCR, blood for EBV, *Campylobacter jejuni*, CMV (IgM and IgG) serology, HIV serology and storage. | Consider discussion with Neurology prior to lumbar puncture |

| SYNDROME | SPECIMEN / INVESTIGATION | COMMENTS |
|---|---|---|
| **CARDIAC** | | |
| **ENDOCARDITIS** | Blood culture (3 separate venepunctures) off antibiotics if possible. Request prolonged incubation.<br><br>If culture-negative consider serology for Q Fever (Coxiella), *Brucella*, *Bartonella, Aspergillus, Mycoplasma pneumoniae and Legionella pneumophila*. | Refer to Blood Culture Taking / Collection Guidelines on iConnect<br><br>Discuss with microbiology |
| **MYOCARDITIS / CARDIOMYOPATHY** | Myocardial tissue for Enterovirus PCR. Blood serology for Enterovirus IgM. | Date of onset is important for interpretation. |
| **PERICARDITIS** | Viral investigations in acute pericarditis do not usually alter clinical management (NEJM 2004:351;2195). If relevant (e.g. chronic), pericardial fluid/biopsy for bacteria/ TB (microscopy and culture). Send separate samples for enteroviral PCR and cytology/histology. | Discuss chronic cases with Microbiology. |
| **RESPIRATORY** | | |
| **SORE THROAT** | Most do not require investigation. If required send throat swab for bacteriology. See glandular fever syndrome. | Anti-streptococcal antibody titres are not useful in acute infection but may be helpful in the diagnosis of complications such as acute rheumatic fever or glomerulonephritis. |
| **GLANDULAR FEVER SYNDROME** | EDTA blood to Haematology for blood film. If negative (and atypical lymphocytes present) consider viral serology (EBV, CMV IgM, Toxoplasma IgM). Consider HIV seroconversion. | Patients should be made aware of a test for HIV and informed how they will receive their result.<br><br>If HIV test is being undertaken - NB label samples ‘high risk/danger of infection’ |

| SYNDROME | SPECIMEN / INVESTIGATION | COMMENTS |
|---|---|---|
| **LOWER RESPIRATORY TRACT INFECTION – ADULTS** | Blood and sputum cultures.<br>Sputum, BAL or throat swab for molecular respiratory screen<br><br>Urine for legionella antigen if suspected.<br><br>Culture empyema fluid.<br><br>Sputum/BAL for legionella culture can be done but has low sensitivity, particularly after antibiotics.<br><br>Samples requesting atypical pneumonia serology are not usually processed. | A history of foreign travel is important to include.<br><br>Discuss refractory cases with Microbiology. |
| **LOWER RESPIRATORY TRACT INFECTION – CHILDREN** | Blood cultures.<br>Nasopharyngeal aspirate for RSV/influenza PCR.<br><br>Immunocompromised – send sputum, BAL or throat swab for molecular respiratory screen (including atypical organisms)<br><br>Samples requesting atypical pneumonia serology are not usually processed<br><br>Management of patients with flu/flu-like illness – Trust Policy | |
| **LOWER RESPIRATORY TRACT INFECTION – IMMUNOSUPPRESSED** | Blood cultures, sputum for AFB, Legionella culture.<br><br>Induced sputum for Pneumocystis, Nocardia, AFB.<br>Extended molecular respiratory screen<br><br>BAL for conventional respiratory pathogens, Pneumocystis, AFB, Legionella, Nocardia, fungi, and molecular respiratory screen/CMV PCR.<br><br>EDTA blood for CMV PCR. | |

| SYNDROME | SPECIMEN / INVESTIGATION | COMMENTS |
|---|---|---|
| **LOWER RESPIRATORY TRACT INFECTION – VENTILATOR-ASSOCIATED** | Blood and broncho-alveolar lavage cultures | |
| **LINE INFECTIONS** | Central and peripheral blood cultures.<br><br>Line tips.<br><br>Send wound swabs/swab of pus if there is evidence of skin and soft tissue infection at exit site | Refer to Blood Culture Taking / Collection Guidelines on iConnect |
| **RENAL** | | |
| **TRANSPLANT** | Follow agreed pre-transplant screen and post-transplant monitoring protocols. | |
| **CAPD PERITONITIS** | Send PD fluid | |
| **POST OPERATIVE WOUND INFECTIONS** | Blood cultures, if febrile. Deep pus. Deep debridement samples. | Superficial samples are not helpful unless the wound has just discharged for the first time. |
| **SKIN AND SOFT TISSUE INFECTIONS** | | |
| **ABSCESS** | Blood cultures if febrile. Send pus. | |
| **BITES** | Blood cultures, swab, pus/debridement samples. | |
| **CELLULITIS** | Blood cultures, send any pus. Swab only where skin is broken.<br>Biopsy if relevant. Deep debridement samples in cases of suspected necrotising fasciitis. | |
| **LEG ULCERS** | Blood cultures if febrile.<br>Superficial swabsare not usually helpful unless signs and suspicion of associated soft tissue infection.<br>Consider biopsy and mycobacterial culture in chronic, refractory or atypical lesions. | |
| **RASHES** | | |
| **VESICULAR** | Fluid/swab or scrape from vesicle for HSV and VZV PCR in viral transport medium. | |
| **HAND, FOOT AND MOUTH DISEASE.** | Vesicular fluid for enteroviral PCR. | Discuss with Microbiology. Diagnosis is usually clinical. |
| **T CELL LYMPHOMA** | Blood serology for HTLV-1 | |

| SYNDROME | SPECIMEN / INVESTIGATION | COMMENTS |
|---|---|---|
| **MACULOPAPULAR** | Blood serology for rubella and parvovirus IgM as appropriate. Consider EBV serology, CMV IgM, syphilis serology and HIV seroconversion.<br><br>If measles suspected send throat swab for measles RNA | Vesicular rashes often start maculopapular.<br><br>Patients should be made aware of a test for HIV and informed how they will receive their result. |
| **ERYTHEMA MULTIFORME/ STEVENS JOHNSON SYNDROME** | Needs clinical information to guide investigations. | Discuss urgently with Dermatology where mucosal membrane involvement. |
| **ERYTHEMA CHRONICUM MIGRANS** | Lyme Disease serology. | |
| **MUSCULOSKELETAL** | | |
| **SEPTIC ARTHRITIS** | Blood cultures, joint aspirate/washout fluid.<br><br>Consider STD samples if risk factors/symptoms suggest *Neisseria gonorrhoae*. | |
| **PROSTHETIC JOINT/ DEVICE RELATED INFECTION** | Blood cultures if acute.<br><br>Joint aspirate (taken in radiology or by orthopaedics / rheumatology) State 'prosthetic' on request form), send multiple samples using separate sterile instruments from theatre. | |
| **OSTEOMYELITIS** | Blood cultures.<br><br>Deep wound swabs, bone biopsy (if possible), operative samples. | |
| **REACTIVE ARTHRITIS/ARTHRALGIA** | Consider *Chlamydia* swab/urine for *Chlamydia* if risk factors/symptoms. Blood serology for rubella, Parvovirus IgM and Hepatitis B surface antigen. | |
| **MYALGIA** | Consider myositis panel.<br><br>Serology for Toxoplasma IgM and influenza (in season).<br><br>Only if relevant clinical picture and exposure/travel history, send blood cultures and consider serology for Leptospira and/or dengue. | Consider discussion with Infectious Diseases if history of recent foreign travel |
| **BORNHOLM'S DISEASE (COXSACKIE VIRUS)** | Serological testing is not offered, as it does not usually alter clinical management. | |

| SYNDROME | SPECIMEN / INVESTIGATION | COMMENTS |
|---|---|---|
| **GASTROINTESTINAL** | | |
| **ACUTE HEPATITIS** | Blood serology for HBsAg, HAV IgM. Hepatitis E, EBV, CMV IgM serology if indicated. | Consider HCV PCR if risk factors<br><br>NB label samples 'high risk/danger of infection' |
| **CHRONIC HEPATITIS/ABNORMAL LFTS** | HBsAg, HCV ab. | |
| **COMMUNITY ACQUIRED DIARRHOEA** | Send faeces. Collect during the period of diarrhoea.<br><br>**Please give clear travel/exposure history (with dates).**<br><br>If part of an outbreak investigation please give details<br><br>If inpatient > 3 days or has received antibiotics in the past month request *C.difficile* testing<br><br>Only if diarrhoea prolonged (>10 days), weight loss, bloating, recent tropical travel or HIV risk - request in addition to culture, ova, cysts and parasites | Routine testing is for Salmonella, Shigella, Campylobacter, E coli O157, Giardia intestinalis and oocysts of Cryptosporidium.<br><br>If amoebic dysentery suspected, discuss with Microbiologist. |
| **HOSPITAL ACQUIRED DIARRHOEA (MORE THAN 3 DAYS INTO ADMISSION)** | If part of an outbreak/cluster of cases contact infection control. | Usually request *C.difficile* toxin testing only.<br><br>Request culture if<br>- Age >65 or <16 and permanent co-morbidity (CVA, renal failure etc)<br>- HIV disease<br>- Neutropaenia<br>- Suspected non-diarrhoeal manifestation of enteric infection |
| **PERITONITIS** | Blood cultures, peritoneal aspirate, intra-operative samples if relevant. | |
| **LIVER ABSCESS** | Blood cultures, pus, *Entamoeba histolytica* serology, stool for *Entamoeba histolytica*. | |

| SYNDROME | SPECIMEN / INVESTIGATION | COMMENTS |
|---|---|---|
| **EYE** | | |
| **CONJUNCTIVITIS/KERATITIS** | Swab for bacterial culture<br>Corneal scrape inoculated onto culture plates<br>Swab/scrape in viral transport medium for viral PCR (adenovirus/HSV/VZV plus *Chlamydia*). | Contact lens keratitis may require *Acanthamoeba* culture arranged with the lab by ophthalmic surgeons if relevant.<br>Please advise if testing for enterovirus indicated. |
| **RETINITIS** | Swab and/or vitreous for HSV/VZV/CMV PCR. | Discuss with Microbiology and Ophthalmology. |
| **ENDOPHTHALMITIS** | Aqueous/vitreous as relevant for bacterial culture. | |
| **GENITO-URINARY** | | |
| **ULCER** | Viral swab for HSV PCR. | |
| **VAGINAL DISCHARGE** | HVS cultured for candida, molecular testing swab for *Trichmonas*, *Chlamydia* and *Neisseria gonorrhoae*. | |
| **Non-specific urethritis (NSU) (MALE)** | Send first pass urine for *Chlamydia* and *Neisseria gonorrhoae.* | |
| **PELVIC INFLAMMATORY DISEASE (FEMALES)** | Send endocervical and urethral swab for chlamydia (can use single request form).<br>Send endocervical swab for *Neisseria gonorrhoae* PCR and culture | |
| **GYNAECOLOGY** | | |
| **CERVICAL OR ENDOMETRIAL INFECTION** | Cervical swab. If obtained – endometrial sample. | If only an HVS is obtainable, please include clear clinical details for culture to be performed. |

# POINT OF CARE TESTING (POCT)

## POINT OF CARE TESTING CONTACT DETAILS


**POCT PROFESSIONAL LEAD & MANAGER:** Dr Derek McKillop
028 9041 1706 / Ext. 21556
derek.mckillop@setrust.hscni.net

**SECTION HEAD & CO-ORDINATOR FOR POINT OF CARE:** Marnie Dodd
028 9041 1541 / Ext. 21511
marnie.dodd@setrust.hscni.net

**POINT OF CARE TEAM:** 028 9041 1541 / Ext. 21511
PointofCare.Team@setrust.hscni.net


*Note: There is no POCT 24/7 cover available. In the absence of a working POCT device please revert to sending samples to the Laboratory or use an alternative POCT device. Inform the POCT team by email and they will action upon their return.*

The Laboratory supports POCT in line with the Regional NI POCT Policy. Whilst the use of POCT devices can aid successful outcomes for patients, there is also a significant potential for causing patient harm. The Trust POCT Management Group oversees POCT within the Trust and the POCT Professional Lead & Manager and the Section Head & Co-ordinator for POCT will assist with ensuring that the analytical performance of devices and user training is adequate and quality controlled. **All applications for new or replacement POCT devices must be sent to the POCT Management Group for approval.** Please contact one of the above POCT staff members for advice relating to POCT.

All policies and standard operating procedures for POCT are available on the Trust Intranet. These include, but are not limited to:

- Blood Gas – ePOC & IL Gem 5000
- Blood Glucose & Ketone – Cobas Pulse & Apexbio Ketosure
- HbA1c – Afinion
- Pregnancy Test – Clinitek Status
- SARS-CoV-2 Testing – Liat
- Urinalysis – Clinitek Status

To access these policies, standard operating procedures and any associated training or competency documents, follow these steps:

- Bring up the Trust Intranet, iconnect, in your internet browser
- Select A – Z Services
- Select Laboratories
- Click on POCT Information, Documentation & Training
- Browse to the relevant information/section

***You can also search for specific documents within the POCT page by using the search bar at the top of the page.***

# VIROLOGY

The Regional Virus Reference Laboratory (RVL) is based at the Royal Victoria Hospital (RVH), and is part of the Belfast Health and Social Care Trust. All virology requests will be transported to the RVL from the Ulster Hospital Laboratory. The Ulster Hospital Laboratory only acts as a post office for these specimens.

Common tests carried out by the RVL include:

- Chlamydia trachomatis
- Cytomegalovirus (CMV)
- Hepatitis Viruses
- Herpes simplex virus (HSV 1 / HSV 2)
- Human Immunodeficiency Virus (HIV)
- Measles Virus
- Mumps Virus
- Q Fever
- Varicella zoster virus (VZV)

**For Virology Request forms please go to: http://www.rvl-belfast.hscni.net/**

For the further details on the service provided by the Belfast Health and Social Care Trust Virology Laboratory, including tests and specimen requirements, please see the Belfast Health and Social Care Trust Laboratory User Manual, available from the Belfast Health and Social Care Trust website. To access the User Manual:

- Go to the Belfast Health and Social Care Trust website http://www.belfasttrust.hscni.net/
- Select Services
- Select Hospital Services
- Select Laboratory Services
- Select the link for the User Manual

Alternatively, use this link:
https://belfasttrust.hscni.net/service/laboratory-services/

**LOOKING FOR SPECIFIC INFORMATION IN THE BELFAST TRUST LABORATORIES USER MANUAL?**

**Type the "test name" or a "keyword" in the text search box on the top tool bar and press enter ( ↵ )**
**(or use 'Crtl+F' keyboard shortcut if search box not displayed)**

# TISSUE PATHOLOGY

The Belfast Health and Social Care Trust Laboratories, based at the Belfast City Hospital (BCH) and Royal Victoria Hospital (RVH), provides the Tissue Pathology service. All tissue pathology requests will be transported to BCH/RVH from the Ulster Hospital Laboratory. The Ulster Hospital Laboratory only acts as a post office for these specimens. Belfast Health and Social Care Trust Tissue Pathology provides the following services at the following sites:

- BCH – Cytopathology (Cervical and Diagnostic) and Histopathology
- RVH – Cytopathology (Diagnostic) and Histopathology

Histopathology and Cytopathology specimens from GP surgeries and hospital inpatients and outpatients collected from the Ulster Hospital are analysed in RVH. Those collected from Ards Hospital are analysed in BCH.

For the further details on the service provided by the Belfast Health and Social Care Trust Tissue Pathology Laboratory, including tests and specimen requirements, please see the Belfast Health and Social Care Trust Laboratory User Manual, available from the Belfast Health and Social Care Trust website. To access the User Manual:

- Go to the Belfast Health and Social Care Trust website http://www.belfasttrust.hscni.net/
- Select Services
- Select Hospital Services
- Select Laboratory Services
- Select the link for the User Manual

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**(or use 'Crtl+F' keyboard shortcut if search box not displayed)**

# IMMUNOLOGY

The Belfast Health and Social Care Trust Regional Immunology Laboratory, based at the Royal Victoria Hospital (RVH), provides the Immunology service for the whole of Northern Ireland. All immunology requests will be transported to the RVH from the Ulster Hospital Laboratory. The Ulster Hospital Laboratory only acts as a post office for these specimens.

Tests carried out by the Regional Immunology Laboratory include:

- Acetylcholine Receptor (ACR) Antibody
- Adrenal Antibodies
- Alveolitis Screen
- Anaphylactic Reaction
- Anti-Cardiolipin
- Anti-Cyclic Citrullinated Peptide (CCP) Antibody
- Anti-Glomerular Base Membrane
- Anti-Mitochondrial Antibody (AMA) Screen
- Anti-Neutrophil Cytoplasmic Antibody (ANCA)
- Anti-Nuclear Antibody (ANA)
- Anti-RNP
- Anti-Skeletal Muscle Antibody
- Anti Smooth Muscle Antibody
- C1 Esterase Inhibitor
- C3 Nephritic Factor
- Coeliac Profile
- DNA
- IgE
- Intrinsic Factor
- Mast Cell Tryptase
- Parietal Cell Antibody

For the further details on the service provided by the Belfast Health and Social Care Trust Immunology Laboratory, including tests and specimen requirements, please see the Belfast Health and Social Care Trust Laboratory User Manual, available from the Belfast Health and Social Care Trust website. To access the User Manual:

- Go to the Belfast Health and Social Care Trust website http://www.belfasttrust.hscni.net/
- Select Services
- Select Hospital Services
- Select Laboratory Services
- Select the link for the User Manual

Alternatively, use this link:
https://belfasttrust.hscni.net/service/laboratory-services/

**LOOKING FOR SPECIFIC INFORMATION IN THE BELFAST TRUST LABORATORIES USER MANUAL?**

**Type the "test name" or a "keyword" in the text search box on the top tool bar and press enter ( ↵ )**
**(or use 'Crtl+F' keyboard shortcut if search box not displayed)**

# MEDICAL GENETICS

The Belfast Health and Social Care Trust (BHSCT) Regional Medical Genetics Laboratory provides the Medical Genetics service for the whole of Northern Ireland. All medical genetics requests will be transported to the BHSCT from the Ulster Hospital Laboratory. The Ulster Hospital Laboratory only acts as a post office for these specimens.

Common tests carried out by the Regional Medical Genetics Laboratory include those for:

- Apo E Phenotyping
- Chromosome Studies
- Fragile X Syndrome
- Cystic Fibrosis
- Genetic Studies
- Dibucaine Numbers
- DNA (Genetic Studies)

For the further details on the service provided by the Belfast Health and Social Care Trust Medical Genetics Laboratory, including tests and specimen requirements, please see the Belfast Health and Social Care Trust Laboratory User Manual, available from the Belfast Health and Social Care Trust website. To access the User Manual:

- Go to the Belfast Health and Social Care Trust website http://www.belfasttrust.hscni.net/
- Select Services
- Select Hospital Services
- Select Laboratory Services
- Select the link for the User Manual

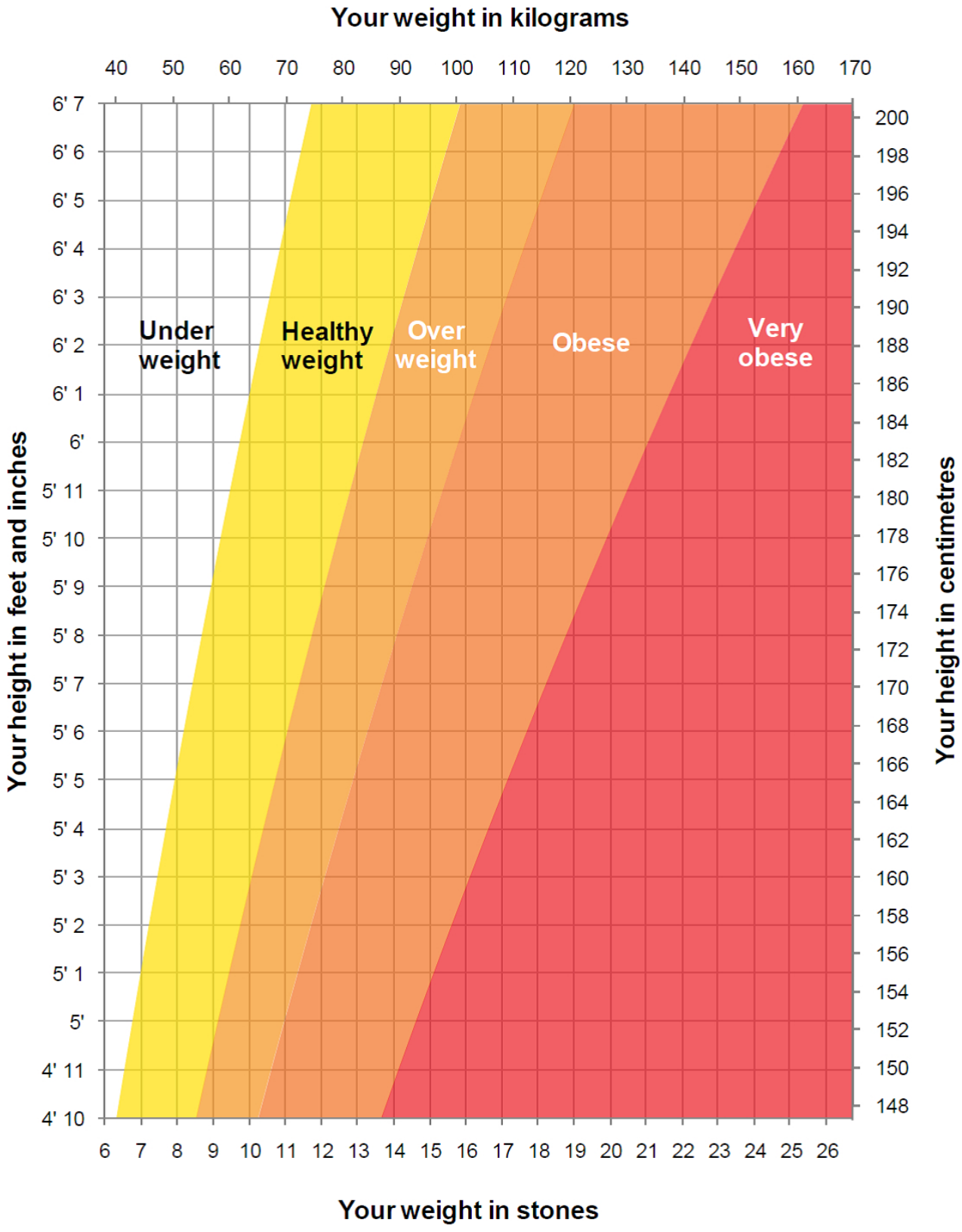
Alternatively, use this link:
https://belfasttrust.hscni.net/service/laboratory-services/

**LOOKING FOR SPECIFIC INFORMATION IN THE BELFAST TRUST LABORATORIES USER MANUAL?**

**Type the "test name" or a "keyword" in the text search box on the top tool bar and press enter ( ↵ )**
**(or use 'Crtl+F' keyboard shortcut if search box not displayed)**

# REFERENCE DATA

**Guidelines for Body Weight**




Source: NHS Livewell (2013)

**Prefixes and Symbols**

| PREFIX | SYMBOL | FACTORS | DECIMAL NUMBER |
|---|---|---|---|
| tera | T | $10^{12}$ | 1,000,000,000,000 |
| giga | G | $10^{9}$ | 1,000,000,000 |
| mega | M | $10^{6}$ | 1,000,000 |
| kilo | k | $10^{3}$ | 1,000 |
| hecto | h | $10^{2}$ | 100 |
| deca | da | $10^{1}$ | 10 |
| deci | d | $10^{-1}$ | 0.1 |
| centi | c | $10^{-2}$ | 0.01 |
| milli | m | $10^{-3}$ | 0.001 |
| micro | µ | $10^{-6}$ | 0.000 001 |
| nano | n | $10^{-9}$ | 0.000 000 001 |
| pico | p | $10^{-12}$ | 0.000 000 000 001 |
| femto | f | $10^{-15}$ | 0.000 000 000 000 001 |
| atto | a | $10^{-18}$ | 0.000 000 000 000 000 001 |


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**Conversion Factors**

| LENGTH | EQUIVALENT TO... |
|---|---|
| 1 inch | 2.54 centimetres |
| 1 centimetre | 0.3937 inches |
| 1 inch | 25.4 millimetres |
| 1 millimetre | 0.03937 inches |
| 1 foot | 0.3048 metres |
| 1 metre | 3.2808399 feet |
| 1 yard | 0.9144 metres |
| 1 metre | 1.0936133 yards |

| AREA | EQUIVALENT TO... |
|---|---|
| 1 square inch | 6.4516 square centimetres |
| 1 square centimetre | 0.1550 square inches |

| VOLUME | EQUIVALENT TO... |
|---|---|
| 1 cubic inch | 16.387 cubic centimetres |
| 1 cubic centimetre | 0.061 cubic inches |

| WEIGHT | EQUIVALENT TO... |
|---|---|
| 1 ounce | 28.35 grams |
| 1 gram | 0.035 ounces |
| 1 pound | 453.59 grams |
| 1 gram | 0.00220462 pounds |
| 1 pound | 0.453592 kilograms |
| 1 kilogram | 2.20462 pounds |

| TEMPERATURE | CONVERSION FACTOR |
|---|---|
| $^{o}$C to $^{o}$F | 9/5 $^{O}$C + 32$^{O}$ |
| $^{o}$F to $^{o}$C | 5/9 ($^{O}$F – 32$^{O}$) |

| MASS | EQUIVALENT TO... |
|---|---|
| 1 kilogram (kg) = | 1000 grams (g) |
| 1 gram (g) | 1000 milligrams (mg) |
| 1 milligram (mg) | 1000 micrograms |
| 1 microgram (mg) | 1000 nanograms |
| 1 nanogram | 1000 picograms |

| VOLUME | EQUIVALENT TO... |
|---|---|
| 1 litre | 1000 millilitres (ml) |
| 1 millilitre | 1000 microlitres |
| 1 pint | Approx. 575 ml |

| OTHERS | EQUIVALENT TO... |
|---|---|
| 1 kilocalorie (kcal) | 4186.8 joules (J) |
| 1000 kilocalories (kcal) | 4.1868 megajoules (MJ) |
| 1 megajoule (MJ) | 238.8 kilocalories (kcal) |
| 1 millimetre of mercury (mmHg) | 133.3 pascals (Pa) |
| 1 kilopascal (kPa) | 7.5 mmHg (pressure) |

# APPENDIX A: Outbreak of Vomiting and Diarrhoea

In the event of a vomiting and/or diarrhoea outbreak, contact the Infection Prevention Control team (Ext. 21538 / 07718 250 573). Faeces specimens should be obtained using the protocol in the Microbiology section and sent for organisms/sensitivities (for investigations of food poisoning) and Clostridium difficile.

In the event that a viral outbreak is suspected the following applies:

Vomitus specimens should be obtained using a clean kidney dish or other clean receptacle and put into a universal container. Both faeces and vomitus specimens should have a virology form completed then sent to the laboratory for onward transfer to the Regional Virus Reference Laboratory (RVL) based at the Royal Victoria Hospital. The Laboratory /Infection Control team should be contacted by telephone so that the RVL can be requested to process the specimens as an outbreak.

# APPENDIX B: Regional/Referral Laboratory Addresses

Clinical Biochemistry Laboratory
Belfast City Hospital
Lisburn Road
Belfast
BT9 7AB
Tel: 028 950 40916

Clinical Biochemistry Laboratory
Royal Victoria Hospital
Grosvenor Road
Belfast
BT12 6BA
Tel: 028 906 33798

Haematology Laboratory
Belfast City Hospital
Lisburn Road
Belfast
BT9 7AB
Tel: 028 950 40920 Ext. 33798

Haematology Laboratory
Royal Victoria Hospital
Grosvenor Road
Belfast
BT12 6BA
Tel: 028 906 33669 Ext. 33619 / 33669 / 32526

Immunology Laboratory
Royal Victoria Hospital
Grosvenor Road
Belfast
BT12 6BA
Tel: 028 906 32689 Ext. 32689

Microbiology Laboratory
Royal Victoria Hospital
Grosvenor Road
Belfast
BT12 6BA
Tel: 028 906 33607 Ext. 34140

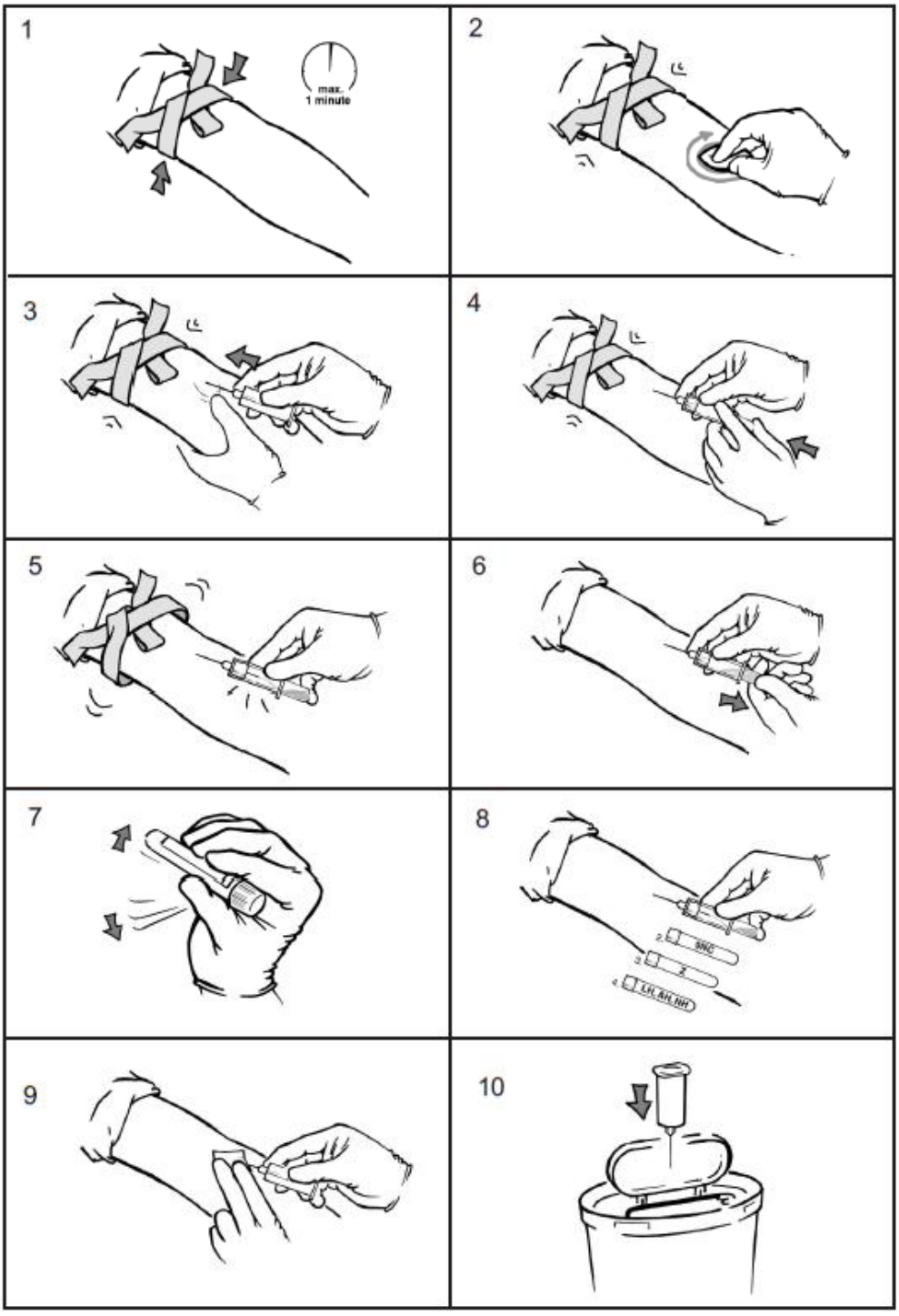
Northern Ireland Blood Transfusion Service (NIBTS)
Lisburn Road
Belfast
BT9 7TS
Tel: 028 903 21414 / 028 905 34610

Regional Virus Reference Laboratory
Royal Victoria Hospital
Grosvenor Road
Belfast
BT12 6BA
Tel: 028 906 35242 Ext. 32662

***The addresses of other, less frequently used, referral/regional Laboratories are available from the Ulster Hospital Laboratory on request.***

# APPENDIX C: Venepuncture Guidance

Before carrying out the procedure detailed below, please ensure you have collected all necessary equipment, including tray, and completed hand hygiene.




1. Apply a disposable tourniquet
2. Put on disposable gloves, disinfect skin and allow to dry
3. Insert Vacuette
4. Attach bottle
5. Drain blood and remove tourniquet
6. Remove bottle
7. Invert bottle (**DO NOT SHAKE**)
8. Collect specimens
9. Safely removal of needle
10. Discard immediately into sharps box

Afterwards please clean the tray, discard the disposable gloves and disposable tourniquet into a clinical waste bin and carry out further hand hygiene. For further details on blood specimen collection read the Trust Venepuncture Policy and the Laboratory Venepuncture Technique and Specimen Collection Guidelines [LAB MAN-55], both available on the Trust Intranet.

# APPENDIX D: Tube Guide and Order of Draw

**RECOMMENDED ORDER OF DRAW AND CONTAINER SELECTION CHART**

South Eastern Health and Social Care Trust – Ulster Hospital Laboratories

**If using a winged blood collection set a discard tube MUST be used to ensure correct fill for sample bottles**

| Take Blood Cultures first, then the required tests in order of draw | | | | | | |
|---|---|---|---|---|---|---|
| ↓ | Item Number | Cap Colour | Draw Volume | Tube Type | Tests | Special Instructions |
| 1 | KBC000151 |  Light Blue | 3 ml | Sodium Citrate | **Haematology:** APTT, Coagulation Screen, D-Dimer, INR, Thrombophilia Screen, Factor Assays, Lupus Anticoagulant | Fill to mid-point of black arrow **Mix well by inversion X 5** |
| 2 | KBC000139 |  Red | 6 ml | Clot Activator | **Some referral tests** (please check lab handbook) | **Mix well by inversion X 5** |
| 3 | KBC000141 |  Gold | 3.5 ml | Clot Activator with Gel | **Biochemistry:** IGs, Lithium, Protein Electrophoresis Some referral tests (please check lab handbook) | **Mix well by inversion X 5** |
| 4 | KBC000219 |  Green | 4 ml | Lithium Heparin with Gel | **Biochemistry:** Admission Profile, Amylase, Bone Profile, B12&Folate, CRP, Electrolytes, Ethanol, Gentamicin, Hormone Profile, Iron, Lipid Profile, Liver Profile, Paracetamol, Salicylate, SHBG, Teicoplanin, Testosterone, Thyroid Function Tests, Troponin T, Vancomycin | **Mix well by inversion X 5** |
| 5 | KBC000149 |  Purple | 4 ml | K3 EDTA | **Biochemistry:** Ammonia, HbA1c, Porphyrins Blood<br><br>**Transfusion:** Maternal Kleihauer<br><br>**Haematology:** ESR, FBC, HbA2, HbF, Malarial Parasites, Plasma Viscosity, Reticulocytes, Sickle Cell | **Mix well by inversion X 5** |
| 6 | KBC000152 |  Pink | 6 ml | K3 EDTA | **Blood Transfusion:** Antibody Investigations, Blood Group and Antibody Screen, Crossmatching, Direct Coombs Test, Cord Blood | **Mix well by inversion X 5** |
| 7 | KBC000147 |  Grey | 2 ml | Sodium Fluoride/ K3 EDTA | **Biochemistry:** Blood Glucose, Lactate | **Mix well by inversion X 5** |
| 8 | KBC000154 |  Royal Blue | 6 ml | Sodium Heparin | **Biochemistry:** Trace Metals | **Mix well by inversion X 5** |

***IMPORTANT: Hold tube in place with the thumb until filled to the required level***

# APPENDIX E: Laboratory Store Order Form *(Hospital)*

**ULSTER HOSPITAL LABORATORY – LAB ORDER FORM**

Please supply: (e.g. Ward, Clinic or Out Patient Clinic)

Name _____ Date _____

| SPECIMEN BAGS | UNIT OF ISSUE | AMOUNT REQUIRED |
|---|---|---|
| Small Clear Specimen Bag (for routine requests) | Single | |
| Yellow Specimen Bag (Clinically Urgent Biochemistry) | Pack/50 | |
| Pink Specimen Bag (Clinically Urgent Haematology) | Pack/50 | |
| Blue Specimen Bag (Clinically Urgent Microbiology) | Pack/50 | |
| High Risk Specimen Bag | Pack/50 | |
| | | |
| **SPECIMEN CONTAINERS** | | |
| Blood Tube - Paediatric Green Top – (No longer available from Lab store. Please order on e-proc (PPC Code to order is KBC000206) | | |
| Blood Tube - Paediatric Purple top - K3EDTA | Pack/50 | |
| Blood Tube – Paediatric Yellow Top – serum separator tube | Pack/50 | |
| Blood Tube - Paediatric Red top – Plain | Pack/50 | |
| Blood Tube - Paediatric Blue top – Coag/INR | Single | |
| Blood Tube - Paediatric Pink Top – Blood Transfusion | Single | |
| 3.2 ml Urine Tube - Yellow top Monovette (Biochemistry only) | Bag/64 | |
| Urine Tube - Green top Monovette with Boric acid (Micro only) | Bag/64 | |
| Urine Tube - Blue top Monovette (Microbiology only) | Bag/64 | |
| Swab Tube – Pink top Liquid Amies eSwab (O&S only) | Pack/50 | |
| 24HR Urine Container - Plain | Single | |
| 24HR Urine Container - Acid | Single | |
| Dry swab for Covid / FLU / RSV testing | Strip/20 | |
| Sputum containers | Single | |
| Sterile Universal containers (White top) | Bag/50 | |
| Faeces containers with spoon (Blue top) | Bag/50 | |
| Post Vasectomy Form / Container | Single | |
| Chlamydia/Gonorrhoea Collection Kits: 'FEMALE' | Single | |
| " " " 'URINE' | Single | |
| QFIT kits (bowel screening) | Single | |
| QFIT patient information leaflets (bowel screening) | Single | |
| | | |
| **REQUEST FORMS** | | |
| Haematology Blood transfusion | Book/20 | |
| Combined Bio/Haem (only required to top up contingency stock) | Pack/100 | |
| Microbiology (only required to top up contingency stock) | Pack/100 | |
| Referral/Regional (only required to top up contingency stock) | Pack/100 | |
| Urgent Biochemistry (only required to top up contingency stock) | Pack/100 | |
| Urgent Haematology (only required to top up contingency stock) | Pack/100 | |
| **Other items – Please Specify below if not listed** | | |
| High risk Danger of Infection Labels | Roll/1000 | |

Orders are made up on **Mon – Wed**, any received after this time will be made up the following week. **Orders are emailed to LabsStore.UHD@setrust.hscni.net**

Laboratory ☎ 028 9041 1701
Lab Store ☎ 028 9041 1700

Rev. 24

# APPENDIX F: Laboratory Store Order Form *(Community)*

**ULSTER HOSPITAL LABORATORY**

Please supply: (e.g. Health Centre / Surgery / Nursing Home)

Name _____ Date _____

| REQUEST FORMS | | UNIT OF ISSUE | AMOUNT REQUIRED |
|---|---|---|---|
| Haematology Blood Transfusion | | Book/20 | |
| Joint Biochemistry/Haematology | | Pack/100 | |
| Microbiology | | Pack/100 | |
| Referral/Regional | | Pack/100 | |
| Urgent Biochemistry | | Pack/100 | |
| Urgent Haematology | | Pack/100 | |
| Post Vasectomy Form/Container | | Single | |
| | | | |
| **VACUTAINER TUBES** | | | |
| Purple Top EDTA | | Pack/50 | |
| Blue Top Sodium Citrate | | Pack/50 | |
| Red Top Plain (no additive) | | Pack/50 | |
| Yellow Top SST | | Pack/50 | |
| Green Top Heparin SST | | Pack/50 | |
| Grey Top Fluoride/oxalate (Blood Sugar) | | Pack/50 | |
| Pink Top Plain (cross match) | | Pack/50 | |
| 3.2ml Yellow Top Urine Tube (Biochemistry only) | | Pack/64 | |
| | | | |
| **PAEDIATRIC** | | | |
| | | | |
| Microtainers | Red Top (plain) | Pack/50 | |
| | Purple Top | Pack/50 | |
| | Yellow Top SST | Pack/50 | |
| | Coagulation/INR Blue Top | Single | |
| | | | |
| **MISCELLANEOUS** | | | |
| Chlamydia/Gonorrhoea Collection Kits: 'FEMALE' | | Single | |
| " " " 'URINE' | | Single | |
| Faeces containers (for O&S) | | Bag/50 | |
| Sputum containers | | Single | |
| Sterile Universal Container (White top) | | Bag/50 | |
| Swab Tube – Pink top Liquid Amies eSwab (O&S only) | | Pack/50 | |
| Dry swab for Covid testing | | Strip/20 | |
| 10ml Urine Monovette with Boric Acid (Green top) | | Pack/64 | |
| Vacutainer needles – black | | Pack/30 | |
| Vacutainer needles – green | | Pack/30 | |
| Pathology Specimen Transport Bags (Clear) | | Single | |
| | | | |
| 24 hour collection bottle<br>**please specify** | | | |
| | | | |
| | | | |

Orders are made up Mondays – Wednesdays, any received after this time will be made and dispatched the following week. Nursing home orders may be emailed in and collected from a designated health centre. If sending a driver to pick up an order please phone Store on the day to confirm this can be accommodated.

**Orders may be emailed to LabsStore.UHD@setrust.hscni.net**

LABORATORY TELEPHONE NO.: 028 9041 1701 Rev. 16
LABORATORY STORE TEL. NO.: 028 9041 1700



***Electronic only document - if printed, this document is uncontrolled***

# APPENDIX G: Malaria Investigation Request Form

## MALARIA INVESTIGATION REQUEST FORM

**This form MUST be completed for all Malaria Investigation requests; if a completed form is not received with the sample it will not be processed.**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Patient Name** | | | | | | |
| **H&C/Hospital No.** | | | | **Sex** | Male | Female |
| **DOB** | | **Ward** | | **Cons** | | |
| **Date** | | **Time** | | **Sig** | | |

| | | | | | |
|---|---|---|---|---|---|
| **VHF Query?** | **If yes – complete SEHSCT Risk Assessment Table below** | **Yes** | | **No** | |

| **TRAVEL DETAILS** (Tick all that apply) | | | |
|---|---|---|---|
| Dates and duration of visit | | | |
| South Africa e.g. Botswana | | Guinea | |
| West Africa | | Liberia | |
| East Africa | | Sierra Leone | |
| Central Africa | | Nigeria | |
| Indian Continent | | South America | |
| Indonesia/Malaysia/Thailand | | Other: Please specify | |

| **Details of Malaria Prophylaxis** | | | |
|---|---|---|---|
| Chloroquine (Nivaquine / Avloclor) | | Maloprim (Deltaprim) | |
| Proguanil (Paludrine) | | Melfoquine (Lariam) | |
| Other e.g. None taken/Unknown (please specifiy) | | | |
| Prophylaxis continued on return for at least 1 month? | | | |

**Complete the table below with the outcome of the SEHSCT VHF Risk Assessment**

| **Low possibility of VHF** | **Risk of VHF** | **High Risk/Confirmed VHF** |
|---|---|---|
| | | |
| **Patient Temperature >38°C** | | |
| **Other relevant information** | | |

# APPENDIX H: Specimen Stability Criteria

| BIOCHEMISTRY SPECIMENS | STABILITY |
|---|---|
| General Biochemistry blood specimens | Potassium, Glucose & Phosphate are unreliable if unseparated for more than 6 hours<br>Other General Biochemistry blood specimens must be received within 48hours, unless these have been pre-centrifuged and a serum/plasma specimen received. Certain tests have Laboratory receipt times of less than this period (see the specific test area within this user manual). |
| Bile Acid and Teicoplanin | Pre-centrifuged - stable for up to 7 days at room temperature |
| Urine Creatinine | Urine (no preservative):<br>2 days at 15 – 25 $^0$C<br>6 days at 2 – 8 $^0$C<br>6months at -15 – -25$^0$C<br>Urine with preservative:<br>3 days at 15 – 25 $^0$C<br>8 days at 2 – 8 $^0$C<br>3 weeks at -15 – -25$^0$C |
| Urine Protein | 24 hours at 15 – 25$^0$C 7 days at 2 – 8$^0$C 1 month at -15 – -25$^0$C |
| **HAEMATOLOGY SPECIMENS** | **STABILITY** |
| Haematology specimens | |
| FBC & ESR | If not being tested on the day the sample is taken, the samples can be stored refrigerated overnight. ESR samples should not be more than 24hrs old and FBC's are not suitable for all parameters after 48hrs. |
| Bone Marrow | Send to Lab immediately for processing as samples must reach referral Labs within 24hrs of being taken |
| Malaria | Send to Lab immediately as samples must be less than 12 hours old for testing |
| Plasma Viscosity | Plasma Viscosity samples are stable up to 7 days at room temperature (they cannot be refrigerated as this may cause cryoproteins to form which may not re-suspend when the sample is returned to room temperature and could give falsely low results). |
| Sickle Cell Screen | Send to Lab immediately<br>(samples should not be older than 3 days for testing) |
| Coagulation specimens | |
| Anti-Xa | Sample should be taken 4 hours post enoxaparin injection for peak levels and must reach the Laboratory within 4 hours. |
| Coagulation | Must be tested within 8 hours of being taken |
| D-Dimer | Must be tested within 12 hours of being taken |
| Factor Assays | Should be received within 4 hours of being taken |
| INR | Must be tested within 24 hours |
| Thrombophilia Screen and Lupus Anticoagulant | Samples for Thrombophilia Screen and/or Lupus Anticoagulant should be received within 4 hours of being taken. |

| MICROBIOLOGY SPECIMENS | STABILITY |
|---|---|
| Urine Plain white top/Sarstedt yellow top sample non-refrigerated<br>Urine Plain white top/ Sarstedt yellow top sample refrigerated | Must be received and processed within 4 hours unless there is an indication that the sample has been refrigerated during the interim period<br>May be accepted and processed up to 48 hours |
| Urine Sarstedt green top (boric acid preservative) with sufficient volume of 10ml. | May be accepted and processed up to 96 hours<br>If below the minimum fill volume of 10mL this may be accepted for Direct Microscopy |
| Swab samples | These should be received within 48hrs |

# APPENDIX I: Faecal Calprotectin Guidance

## FAECAL CALPROTECTIN – GUIDANCE

### What is it?

Faecal Calprotectin (FC) is a stable protein found in neutrophils. Calprotectin is released into the faeces when neutrophils gather at the site of any gastrointestinal tract inflammation. Calprotectin is resistant to enzymatic degradation by intestinal bacteria so can be easily measured in faeces.

### What assay is used to measure Faecal Calprotectin?

The South Eastern Trust has been commissioned to provide Faecal Calprotectin testing for the Northern Ireland HSC. The method used is the Diasorin's LIAISON Calprotectin assay.

### Is the test accurate?

No diagnostic test is 100% accurate. Currently, Calprotectin assays are not standardised, which results in different manufacturer tests giving markedly different values. When using National Pathways it is important to understand the performance of the local assay at the specified cut-off. 'Cut-offs' of 50 and 100 µg/g are commonly quoted in National Pathways. Below are the sensitivity and specificity of the Diasorin's LIASION assay published recently for these diagnostic cut offs'[1] and cut-offs from a meta-analysis of disease activity[2,3].

| | Cut Off (µg/g) | Sensitivity | Specificity |
|---|---|---|---|
| Diagnosis of IBD[1] | 50 | 98.0% | 69.6% |
| | 100 | 92.1% | 88.4% |
| Disease activity[2,3] | 50 | 92% | 60% |
| | 100 | 84% | 66% |
| | 250 | 80% | 82% |

### Why use it?

NICE and the British Society of Gastroenterology (BSG) have recommended the use of calprotectin to aid in the differential diagnosis of inflammatory Bowel Disease (IBD) or Irritable Bowel Syndrome (IBS) in adults[4,5].

In secondary care BSG has suggested in defined circumstances the use of faecal calprotectin to assess disease activity/mucosal inflammation and to inform decisions on treatment escalation or de-escalation[5].

### When not to use it

Faecal Calprotectin should not be used in the following situations:

- **Patients fulfilling NICAN red flag criteria who should be referred in the usual way via existing red flag pathways**
- As a screening/surveillance tool for polyps or bowel cancer.
- For routine monitoring of all patients with IBD.

- In primary care for diagnostic clinical assessment outside of its use in differentiating between IBD and IBS

**How do you test for it?**

Calprotectin is measured in a single stool: only 5 grams of faeces (enough faecal material to fill approx. 1/3 of the container – walnut size) is required to be collected in a standard faeces collection pot.

It should be collected from the first bowel motion of the day and stored at room temperature. Please ensure the accurate date of collection is recorded to avoid sample rejection.

Preferably sample should be received by the lab for analysis within 3 days, however based on local data samples are accepted up to 7 days from date of collection.

Please note that the minimum retest interval (MRI) for this test is 14 days. The objective of the MRI is to avoid inappropriate referrals resulting from transient elevations in FCal due to test imprecision or non IBD causes of inflammation ( ie NSAID, PPI etc). **Therefore, to avoid rejection please ensure confirmatory samples are not collected during the MRI.**

**What are the limitations of the test?**

Calprotectin is a **very sensitive** measure of intestinal inflammation, however it is **not specific** for the cause of inflammation. Any cause of intestinal inflammation is able to produce an elevated concentration.

Raised levels are found:

- Iatrogenically:
  - NSAID use
  - Aspirin use
  - PPI use

  Based on the literature and guidance we recommend, were clinically appropriate, discontinuing medication and repeating in 2-4weeks were results are in the equivocal range. Continued use of these drugs should be considered in the interpretation of FC results
- Pathologically
  - IBD
  - Coeliac disease
  - Infective colitis
  - Diverticulitis
  - Gastrointestinal infections
  - Cirrhosis
  - Pancreatic exocrine insufficiency
  - Microscopic colitis
  - Peptic ulceration
  - Colonic adenomas and colorectal cancers
  - Bile salt malabsorption

Calprotectin results can be falsely high in blood-stained samples or falsely low in patient with granulocytopenia due to bone marrow depression[6].

In children older than 4 years of age, adult cut off values can be cautiously used, mindful that reference values at this age range have not been irrefutably established. Consider direct referral to paediatrics in children beneath this age if IBD suspected?[6-10]

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# FAECAL CALPROTECTIN - A PRIMARY CARE GUIDE

Dear Patient

This Calprotectin Patients guide provides essential information for patients undergoing faecal calprotectin testing. The Calprotectin page within Lab Tests Online-UK provides useful background information to help you understand why you have been asked to provide a sample for faecal calprotectin.

Collecting the faecal (poo) sample:

- You will be given a test request form by your GP and a container for your faecal sample
- Wear disposable rubber or plastic gloves.
- It should be collected from the first bowel motion of the day and stored at room temperature.
- Label the container with your name, date of birth.
- Please ensure the accurate date of collection is recorded on the form, to avoid sample rejection.
- It is important that the bowel motion you collect your faecal sample from has not been in the toilet, as this may affect the result. Suggested ways to catch the poo sample are:
    - Folded pieces of toilet paper
    - spread clean newspaper or plastic wrap over the rim of the toilet
    - A clean disposable container
- Unscrew the lid of the container and using the spoon collect a small faecal sample (enough faecal material to fill approx. 1/3 of the container – size of a small walnut). It is important that sufficient sample is provided; otherwise the test may not be able to be completed.
- Transfer the spoon with poo sample back into the container and screw the lid tightly
- Wash your hands thoroughly and dispose of any dirty equipment safely
- Place the container into the plastic bag on the back of the form and seal
- Return the completed form and the container with the faecal sample to your GP the same day. Your doctor will advise you on which days the lab collects samples.