

South Glasgow Hospitals Haematology Handbook

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General Information

Postal Address

Haematology Department
Level 1
New South Glasgow Laboratories and FM Building
Queen Elizabeth University Hospital
1345 Govan Road
Glasgow
G51 4TF

The Haematology and Blood Transfusion Services for South Glasgow is located on the Queen Elizabeth University Hospital campus. The Department of Haematology is located in a purpose built state of the art laboratory building.

A satellite laboratory is located in the Victoria ACH hospital

Senior Staff

Consultant Haematologists

Dr A McCaig	0141-354-9083
Dr Alastair Hart	0141-354-9087
Dr Gail Loudon	0141-354-9089
Dr I. MacDonald	0141-354-9082
Dr S Rhodes	0141-354-9090
Prof B Gibson	0141-451-5643
Dr E Chalmers	0141-451-6505
Dr F Pinto	0141-452-5646
Dr N Heaney	0141-452-6686
Dr D McLaughlin	0141-354-9084
Dr C Halsey	Via Switchboard
Dr S Chaudhury	Via Switchboard

Technical Services Manager

Mr Tom Moffat 0141-354-9095

Quality/Training/POCT Manager

Miss Maureen McBrearty 0141-354-9093

Laboratory Sector Manager

Mrs Claire McKie 0141-354-9094

A member of the medical staff will always be available for advice on relevant investigation, interpretation of results and, where appropriate, the clinical management of Haematology problem. He/She may be contacted via the switchboard outwith normal laboratory hours.

Telephone Numbers

Haematology Office (General Enquiries and results)	0141-354-9100
Haematology Laboratory	0141-354-9097
Coagulation Laboratory	0141-354-9097
Transfusion Laboratory	0141-354-9104
Fax No.	0141-232-7982
Victoria ACH Laboratory	0141-347-8141

QEUH Lab

Routine hours

Monday to Sunday 8.00am to 8.00pm

Core Hospital Work

Monday to Sunday 8.00pm to 8.00am

Victoria ACH Lab

Routine hours

Monday to Friday 8.45am to 5.00pm

When emergency specimens for transfusion or coagulation are required, please make contact with the appropriate laboratory before taking blood. THIS APPLIES BOTH IN AND OUT OF CORE WORKING HOURS and will ensure unnecessary delays are avoided.

Outside Normal Laboratory Hours

There are medical and BMS rotas for emergency/out of hours services. The BMS can be contacted on page.17602 (blood transfusion) or page 16645 (haematology) or via the switchboard as required. The out of hours laboratory service primarily provides a core haematology and transfusion service. Other tests can be arranged by discussion with the on-call haematologist.

Repertoire of Tests provided Out of Hours

Laboratory Section	Analysis – Outwith Normal Working Hours
Blood Transfusion	Cross-Match , Group & Save, Group & Direct Coombs Test, Blood Product issue
Blood Transfusion <i>Requests for Blood Products</i>	Please allow the following times for Blood Products to be prepared from receipt of sample if required: Concentrated Red Cells – 45mins Special Requirements Eg. Fresh, CMV Neg, Irradiated – By arrangement Platelets – 30mins Fresh Frozen Plasma – 30mins Cryoprecipitate – 30 mins
Routine Haematology	Full Blood Count, Blood Film, Retics, Malarial Parasites, Sickle Cell Screening Test, ESR, Glandular Fever Screening Test
Coagulation	Coagulation Screen, INR, D-Dimers, Anti Xa,

Results Enquires

Telephoning for results can waste valuable time, both in the ward and in the Haematology department. Before telephoning the department users should ALWAYS use the ward terminals to look for results. If they are not there it is likely that the analyses are not complete. Only as a last resort should the department be telephoned for results. All extremely abnormal results will be phoned automatically

Urgent requests

All urgent requests for QEUE haematology should be telephoned to 0141-354-9097 and for blood transfusion to 0141-354-9104. All urgent samples for Victoria ACH should be telephoned to 0141-347-8141

Patient Identification, sample labelling and specimen collection

Collection of Specimens

Please note the following points relevant to collection (or venepuncture) of good quality specimens:

- **CONFIRM THE IDENTITY** of the patient **PRIOR** to sampling
- Never pre-label specimen tubes
- Ideally, the patient should be resting for a full five minutes before specimen collection
- Use good quality veins
- Never take blood from a drip arm
- Do not take samples for coagulation studies from heparinised lines
- Avoid prolonged application of the tourniquet both for patient comfort and to avoid haemolysis
- Samples should be filled to the fill line as marked on the bottle. This is essential for coagulation related tests
- Following collection, specimen bottles containing anticoagulant should be inverted several times to ensure adequate mixing
- Following collection, ensure specimen bottle is labelled as per the guideline provided on the next page
- Ensure Request Form is labelled and that these details match those on the specimen bottle
- Use a safe procedure at all times and dispose of sharps in sharps-boxes provided
- Affix a "Danger of Infection" label on specimen tube and request form if appropriate
- All specimens and request forms must be secured for transportation in the specimen compartment of an approved specimen transport bag (affixed to the Request Form)
- Specimen tubes or request forms which are blood soiled will not be analysed
- Appropriate specimen containers must be used for each laboratory test

Blood Venepuncture System

A colour-coded specimen container (relating to tube particulars such as type and presence of anticoagulant, and relating to suitability and use for individual laboratory tests) and vacuum assisted venepuncture system (Greiner Vacuette™) operates throughout NHS GG&C, for the purposes of laboratory specimen collection.

Wall charts and posters detailing the safe use of this system, and the correct container for each test, are posted in most clinical areas throughout the Division. Additional guidance or information regarding the use of the Greiner Vacuette™ system may be obtained by contacting Hospital Head Phlebotomist staff.

Phlebotomy Services for Wards and Clinics

A dedicated team of trained phlebotomists, covering all acute medical and surgical wards, operates throughout South Glasgow Hospitals. Public Holidays are covered by a limited service, with details available from each Hospital Head Phlebotomist.

Sample labelling and collection

Haematology

A fully completed haematology request form must accompany a properly identified sample in all cases.

Minimal identifying particulars for haematology on **both** the request form and sample are:

1. Surname
2. Forename
3. CHI number (or other unique primary identifier ie TJ number)
4. Date of Birth

The form should also include:

5. Gender
6. Source of request i.e. ward and consultant in charge
7. Brief clinical details
8. Date of request
9. Investigation requested
10. Signature of requesting doctor and bleep number

Trakcare forms and Trakcare labels on samples are acceptable provided that the correct label is allocated to the correct sample type.

ICE labels on samples (without forms) are acceptable provided that the correct sample type has been provided for the analysis requested.

Please note unlabelled or inadequately labelled samples will not be accepted for analysis. In these circumstances the doctor or unit making the request will be notified and a fresh, suitably identified sample requested. Under no circumstances will changes be allowed to any samples. Please do not use large addressograph labels on samples as the analysers are not compatible with these labels.

Blood Transfusion

Sample identification is of critical importance in blood transfusion. The process of ordering blood for possible transfusion involves both a request for a laboratory investigation and also for a prescribed therapeutic product. The vast majority of major transfusion complications, although rare, relate to clerical errors and it is therefore important to follow recommended procedures for patient identification. Sample bottle details should be completed at the patients' bedside after the sample has been obtained. The patient should be asked, where possible, to confirm the details on the request are correct. Sample bottles should NEVER be pre-labelled or completed away from the patients' bedside. Addressograph labels WILL NOT be accepted on sample bottles under any circumstances.

All samples and requests must have the following minimum identifiers:

1. Surname

2. Forename
3. CHI number (or other unique primary identifier ie TJ number)
4. Date of birth
5. Signature of person taking the sample

The form should be completed as per the Haematology form guidance as above.

When dealing with an unidentified unconscious patient the unique A&E or emergency unit number (ward 61) should appear on both the sample and the form. In the interests of safety any sample that has had details altered will be rejected.

2nd Sample Policy for Blood Transfusion

In order to provide cross-matched blood (or group specific blood products) the GG&C blood bank database must have 2 ABO group samples on record – One current and one previous result in the current database OR - a current valid sample and a second sample taken during the current episode, where no historic group is available. These samples should come from separate venepuncture events, ideally taken by two different people at two different times and always with separate request forms.

If it is an emergency and there is no time to wait for a second sample to be processed in the lab, the lab will issue Group O. The RhD group will be dependent on the first sample, age of patient and gender of patient.

Transport of Specimens

Hospital Samples

Vacuum Tube Specimen Delivery Systems

Vacuum tube transportation systems operate extensively for the transportation of laboratory specimens. Should users have any problems with this facility then they should contact the facilities/estates.

Portering Services

Specimens are uplifted from the various clinical units and operating theatres by Porters on a regular basis throughout the day.

Primary Care – Van & Taxi Specimen Collection Service

Coordinated and managed by hospital Facilities Managers (NOT by the Department of Haematology), a van and taxi specimen collection service operates, there are multiple drop-offs per day, for the routine collection and delivery of laboratory specimens and reports between regular service users in General Practice, Primary Care Health Centres, and local Hospitals to the individual laboratories of the Department. The following information serves as a guide to these collection services. All enquiries relating to van and taxi services should be directed to the appropriate hospital Facilities Manager.

Sending Specimens by Post

The Royal Mail supplies prepaid, single-use mailing containers (Safebox) designed to meet current legislation with regards to posting laboratory specimens. As detailed in Royal Mail guidelines, regardless of container, the following must apply for posted specimens:

- The primary container (specimen bottle) shall be leak-proof and shall not contain more than 500ml.
- There shall be absorbent material (e.g. cotton wool, which shall be present in sufficient quantity to absorb the entire content of the primary container) placed between the primary container and a secondary container.
- The secondary container must be leak-proof.
- The secondary packaging shall not contain more than 4 litres (includes the scenario of multiple primary containers placed into a single secondary container).
- Secondary container should be inconspicuously labelled with "Biological Material", "Biohazardous Sample", or similar, and have the laboratory destination address clearly marked.

Procedure Restrictions

Patients from whom specimens **MUST NOT BE SENT** without approval of an Infectious Disease / Control Clinician:

- Specimens from patients known or suspected to have SARS.
- Specimens from patients with possible or confirmed Viral Haemorrhagic Fever.
- Any other hazard category 4 pathogens such as Ebola.

Repertoire of Investigations

Glasgow South Sector haematology laboratories are accredited by UKAS to ISO Standard: 15189:2012 : (No 9604), for all tests as described within our schedule of scope held on the UKAS website : Please see: [QEUEH UKAS](#) for full accredited scope.

The appropriate containers for haematological tests are available from the stores department. The type and amount of anticoagulant present varies with the investigations requested and the amount of blood required. The ratio of blood to anticoagulant is fixed with the result that underfilling of specimen bottles can lead to spurious results.

The different haematological tests and bottle required are listed below:

Test	Bottle Required	Further information	Time limit for Add ons
Full Blood Count (FBC)	Purple	Includes WBC, Hb, Platelets and red cell indices & WBC Diff	NA
ESR	Purple		24 hrs
Reticulocyte Count	Purple	Performed automatically on new cases with significant anaemia.	24 hrs
Blood film	Purple	Will be automatically performed if clinical details or FBC results indicate	24 hrs
Glandular Fever Screen	Purple	Timing of illness is often helpful	24 hrs

Malarial Parasites	Purple	Best performed when febrile – please indicate country visited and whether prophylaxis taken.	4 hrs
Sickle Cell Screen	Purple		24 hrs
Kleihauer	Purple		24 hrs
Plasma Viscosity	Purple		5 days- only if sample has not been refrigerated
Haemoglobinopathy screen	Purple		24 hrs
Hb H Inclusions	Purple		24 hrs
Cell Markers	Purple	Require prior arrangement	NA
Coagulation Screen	Blue	Please ensure bottle is filled to the level indicated	4hrs
INR (warfarin control)	Blue	Please ensure bottle is filled to the level indicated	4hrs
Heparin control (APTT ratio)	Blue	Please ensure bottle is filled to the level indicated	4hrs
Anti Xa for some Unfractionated Heparin- Others go to GRI- see below	Blue	Please ensure bottle is filled to the level indicated	4hrs
Platelet Aggregation Studies-for paediatric patients	Bottles sent from Labs	By Appointment with Lab only	NA
Factor Assays- Intrinsic/Extrinsic Pathways – For Paediatric patients	Blue- number of bottles dependant on number of tests required	Please ensure bottle is filled to the level indicated	NA
von Willebrands Factor Antigen and RiCof Assay- Paediatric patients	Blue x2	Please ensure bottle is filled to the level indicated	NA
Anti Thrombin- Paediatric Patients	Blue	Please ensure bottle is filled to the level indicated	na
Thrombophilia screen (AT III, protein C, Lupus anticoagulant, APCr)	5 x Blue	Please ensure bottle is filled to the level indicated Please notify the lab in advance. Performed at GRI	NA
D-Dimers	Blue		4hrs
Blood Group and Retain	Pink		See guidelines

			below
Cross-match	Pink		See guidelines below
Antibody screen	Pink		See guidelines below
Direct Coombs Test (DCT)	Purple		See guidelines below
Urinary Haemosiderin	20ml urine in sterile container		NA

Miscellaneous

Other investigations (e.g. Bone Marrow, Haemolytic studies, Platelet aggregation) may be arranged after discussion with the Haematology Medical Staff.

Reports

Hardcopy paper reports are sent to all locations with the exception of all in-patient locations. Electronic reports are available on Clinical Portal, Trakcare, SCI store, Sunquest ICE and all interfaced GP systems (Vision EMIS). The electronic report on Clinical Portal does not include details of the requestor.

Handling of personal information:

All data held within the department is done so in compliance with the NHSGGC confidentiality and data protection policy and the NHS Code of Practice on confidentiality. Records and specimens are held in compliance with the Royal College of Pathology guidelines on retention and storage of pathological records and specimens, 2015, 5th Edition

Factors Affecting Performance of Tests and Results

Investigation	Sample Unsuitability	Other Requirements
Coagulation Screen	Sample received > 4 hours from time of venepuncture	-
INR	Sample received > 4 hours from time of venepuncture	-
LMW Heparin (Anti-Xa) Assay*	Sample received > 2 hours from time of venepuncture	Sample must be taken 3.5 – 4.0 hours post dosage
Lupus Screen	Sample received > 2 hours from time of venepuncture	-
Thrombophilia Screen	Sample received > 2 hours from time of venepuncture	-
AT or PC or FPS or APCR-V	Sample received > 2 hours from time of venepuncture	-
Factor Assay	Sample received > 2 hours from time of venepuncture	FV and FVIII assay samples preferably < 1 hour from time of venepuncture
Intrinsic/Extrinsic Pathway	Sample received > 2 hours from time of venepuncture	FV and FVIII assay samples preferably < 1 hour from

		time of venepuncture
Inhibitor Screen	Sample received > 4 hours from time of venepuncture	-
Inhibitor Assay	Sample received > 4 hours from time of venepuncture	Preferably < 1 hour from time of venepuncture
Von Willebrand Screen	Sample received > 2 hours from time of venepuncture	Samples preferably < 1 hour from time of venepuncture
Underfilled or overfilled samples will be rejected. All bottles must be filled to the correct level and mixed gently by inversion. Avoid frothing and mechanical damage.		

Turnaround Times

Laboratory Section	Analyses	Turnaround Time (Days)
Blood Bank		
	Group & Save	6 Hours
	Routine X-Match	12 Hours
	Emergency X-Match	40 minutes
	Antibody Investigation	1 Day
	Kleihauer	1 Day
Coagulation		
	Coagulation Screen	4 Hours
	INR	2 Hours
	D Dimer	2 Hours
	Factor Assay (paediatrics)	1-3 days dependant on urgency
Haematology		
	Full Blood Count	2 Hours
	ESR	8 Hours
	Blood Film	2 Days
	Hb'opathy Routine Screen	14 Days
	Glandular Fever	1 Day
	Malarial Parasites	3 Days
	Bone Marrow	14 Days
	Reticulocyte Count	2 Hours
Haematinics		
	Serum B12	3 Days
	Serum Folate	3 Days
	Serum Ferritin	3 Days

Haematology Reference Ranges

Reference Ranges for Infants

Test	Birth	Day 3	Day 7	Day 14	1 month	2 months	3-6 months
RBC x10 ¹² /l	5.00 – 7.00	4.00 – 6.60	3.90 – 6.30	3.60 – 6.20	3.00 – 5.40	3.10 – 4.30	4.10 – 5.30
Hb g/l	140 - 220	150 - 210	135 - 215	125 - 205	115 - 165	94 - 130	111 - 141
Hct l/l	0.450 - 0.750	0.450 - 0.670	0.420 - 0.660	0.310 - 0.710	0.330 - 0.530	0.280 - 0.420	0.300 - 0.400
MCV fl	100 - 120	92 - 118	88 - 126	86 - 124	92 - 116	87 - 103	68 - 84
MCH pg	31.0- 37.0	31.0 - 37.0	31.0 - 37.0	31.0 - 37.0	30.0 - 36.0	27.0 - 33.0	24.0 - 30.0
MCHC g/l	300 - 360	290 - 370	280 - 380	280 - 380	290 - 370	285 - 355	300 - 360
Retic x10 ⁹ /l	120 - 400	50 - 350	50 - 100	50 - 100	20 - 60	30 - 50	40 - 100
WBC x10 ⁹ /l	10.00 – 26.0	10.00 – 26.00	10.00- 26.00	6.0 – 21.0	6.00 – 21.00	5.0 – 15.0	6.0 – 17.0
Neuts x10 ⁹ /l	2.70 - 14.40	2.70 - 14.40	2.70 - 14.40	1.50 - 5.40	1.50 - 5.40	0.70 – 4.80	1.00 - 6.00
Lymphs x10 ⁹ /l	2.0 – 7.3	2.0 – 7.3	2.0 – 7.3	2.80 - 9.10	2.80 - 9.10	3.3 – 10.3	3.30 – 11.5
Mono x10 ⁹ /l	0.0 – 1.9	0.0 – 1.9	0.0 – 1.9	0.10 – 1.7	0.10 – 1.7	0.40 – 1.2	0.20 – 1.3
Eos x10 ⁹ /l	0.0 – 0.85	0.0 – 0.85	0.0 – 0.85	0.0 – 0.85	0.0 – 0.85	0.05 – 0.9	0.1 – 1.10
Baso x10 ⁹ /l	0.0 - 0.10	0.0 - 0.10	0.0 - 0.1	0.0 - 0.10	0.0 - 0.10	0.02 - 0.13	0.02 - 0.13
Plats x10 ⁹ /l	100 - 450	210 - 500	160 - 500	170 - 550	210 - 500	210 - 650	200 - 550

Reference: Dacie & Lewis Practical Haematology 12th Edition

** WBC & Differential, by expert local review

Reference Ranges for children and adults

Test	1 Year	2-6 Years	6-12 Years	Adult male	Adult female
RBC x10 ¹² /l	3.9 – 5.1	4.0 – 5.2	4.0 – 5.2	4.0 – 5.2*	4.0 – 5.2 *
Hb g/l	111 – 141	110 - 140	115 – 155	130 – 180 *	115 – 165 *
Hct l/l	0.300 – 0.380	0.340 – 0.400	0.350 – 0.450	0.400 – 0.540 *	0.370 – 0.470 *
MCV fl	72 - 84	75 - 87	77 – 95	83 - 101	83 - 101
MCH pg	25.0 – 29.0	24.0 – 30.0	25.0 – 33.0	27.0 – 32.0	27.0 – 32.0
MCHC g/l	320 - 360	310 – 370	310 – 370	315 - 345	315 - 345
Retic x10 ⁹ /l	30 - 100	30 – 100	30 – 100	50 - 100	50 - 100
WBC x10 ⁹ /l	6.0 – 16.0	6.0-17.0	4.50 13.0	4.0 – 10.0	4.0 – 10.0
Neuts x10 ⁹ /l	1.0 – 8.0	1.5 – 8.5	1.5 – 8.0	2.0 – 7.0	2.0 - 7.0
Lymphs x10 ⁹ /l	3.4 – 10.5	1.8-8.4	1.5 – 5.0	1.1 – 5.0 *	1.1 – 5.0 *
Mono x10 ⁹ /l	0.2 – 0.9	0.15 – 1.30	0.15 – 1.30	0.2 – 1.0	0.2 – 1.0
Eos x10 ⁹ /l	0.05 – 0.9	0.05 – 1.10	0.05 – 1.0	0.02-0.5	0.02- 0.5
Baso x10 ⁹ /l	0.02 – 0.13	0.02 – 0.12	0.02 - 0.12	0.02 – 0.1	0.02 – 0.1
Plats x10 ⁹ /l	200 - 550	200 - 490	170 - 450	150 - 410	150 - 410

Reference: Dacie & Lewis Practical Haematology 12th Edition

*Adult Hb, Hct, RBC and Lymph by expert local review

Children WBC & Diff, by expert local review

ESR Reference Ranges for adults

Test	17-50 Years	50-61 Years	61-70 Years	>70 Years
ESR (male) mm/hr	≤ 10	≤ 12	≤ 14	≤ 30
ESR (female) mm/hr	≤ 12	≤ 19	≤ 20	≤ 35

Reference: Dacie & Lewis Practical Haematology 12th Edition

HbA2 and HbF Reference Ranges for adults

Test	
HbA2 %	2.0 – 3.5
HbF %	< 1.0

Reference: Barbara J Bain Haemoglobinopathy Diagnosis 2nd Edition

Plasma Viscosity

1.5-1.7 mPa

Reference: Dacie & Lewis Practical Haematology 12th Edition

Haematinic Reference Ranges for adults

Test	
Serum B12 ng/l	200 - 883
Serum Folate ug/l	3.1 - 20
Serum Ferritin (male) ug/l	15 - 300
Serum Ferritin (female) ug/l	15 - 200

Reference: Dacie & Lewis Practical Haematology 12th Edition

COAGULATION

	Result	Ratio
Prothrombin Time (PT)	9 - 13 secs.	0.83 - 1.11
Partial Thromboplastin Time (APTT)	27 -36 secs	0.85 – 1.14
Thrombin Time	11-15 secs	0.8 – 1.2
Fibrinogen	1.7 - 4.0g/l	1.7 - 4.0g/l
APTT ratio	therapeutic range	1.8 - 2.8
INR	therapeutic range	2 - 4.5
(may vary depending on indication for anticoagulation)		
D-Dimers	0-243ng/ml	
D-Dimers for exclusion of VTE	<230ng/ml	

All haemostasis reference ranges are locally derived based on a normal range study carried out within NHS GGC.

THROMBOPHILIA (Performed at GRI)

Antithrombin III activity	83 – 123 iu/dl
Protein C activity	71 – 146 iu/dl
Protein C Ag	72 – 160 U/dL
Protein S free Ag	65-137 iu/dl (female) 75 - 148 iu/dL(male)
APC sensitivity ratio	2.5 – 4.5
APC resistance ratio	0.9 -1.17
DRVVT Screen	0.87 – 1.21 ratio
Anticardiolipin Ab	IgG <20.0 U/mL IgM <20.0 U/mL

Coagulation Investigations

Coagulation screen will initially comprise APTT, PT and thrombin time. A fibrinogen level will be reflexed if the thrombin time is prolonged. An FBC sample for platelet count should also accompany the coagulation studies sample. This will usually be all that is required. D-Dimers may be useful in cases of DIC, fibrinolysis and DVT.

Please note: Samples for coagulation should not be taken from heparinised peripheral or central lines as they may give spuriously abnormal results.

More detailed investigation of clinically significant coagulation abnormalities such as coagulation factor assays and platelet function tests can be arranged, where appropriate, on discussion with the Haematology Medical Staff.

Anticoagulant Therapy

This is normally initiated with heparin for immediate effect. Warfarin is often started simultaneously but takes approximately three days to become fully effective at which time heparin is usually discontinued.

Local Clinical Guidelines have been produced for:

1. Prophylaxis of Venous Thromboembolism (VTE)
2. Management of suspected Deep Vein Thrombosis (DVT)
3. Management of Pulmonary Embolism (PE)

These are available on each ward/unit and should be referred to when appropriate.

Laboratory Monitoring

Low Molecular Weight Heparins (LMWH) are now in common use for therapy of VTE. Therapeutic monitoring is only rarely required (exceptions may include patients requiring haemodialysis or during pregnancy where anti-Xa measurement may be necessary – this should be arranged on consultation with the lab).

Where therapeutic doses of intravenous unfractionated heparin (UH) are used, the APTT should be measured 6-12 hours after initiating therapy aiming to achieve an APTT ratio between 1.5 and 2.5.

When full anticoagulation with UH is required our current recommended practice is to administer a loading IV dose of 5000iu followed by a continuous infusion of approximately 20 iu/kg/ hour (usually 1000-1500 iu/hr) via syringe driver.

Warfarin (further details can be found in the Junior doctors handbook)

When treating established VTE warfarin is started shortly after heparin therapy with a 4-5 day overlap normally required. An initial loading dose is given (usually 10mg day 1, 5mg day 2, 5mg day 3) and subsequent daily dose is adjusted according to the INR (International Normalised Ratio). This should be checked as often as is required (usually on alternate days for the first 7-10 days) until a stable INR Target Level (see below) and stable Warfarin dose (normally from 3-9 mg/day) is reached.

Recommended INR Targets are:

INR 2.5 Treatment of DVT, PE, systemic arterial embolisation, Mitral stenosis, atrial fibrillation.

INR 3.5 Recurrent DVT/PE, mechanical prosthetic heart valves.

Anticoagulant Clinics

When the target INR is achieved patients can be followed-up at the hospital anticoagulant clinic. Referral should be made via the The Glasgow Anticoagulant Service

The above is only intended to be a brief guide to standard anticoagulant therapy and monitoring.

Blood Transfusion

Blood Sample

A 6ml EDTA sample (pink top tube) is required for blood grouping.

For crossmatching and product issue 2 x EDTA samples (pink top tube) are required. These samples should come from separate venepuncture events, ideally taken by two different people at two different times and always with separate request forms.

Routine matching (including Group & Retain)

Blood requirements for surgery vary depending on the procedure in question. Blood requirements may be predicted from analysis of previous use and in those cases where blood is rarely required a group and screen procedure is recommended. In these circumstances ABO and Rhesus D group is determined and plasma tested for the presence of irregular red cell antibodies. The plasma sample will be held in the laboratory for 14 days (72 hours only if pregnant or transfused in the previous 3months) and if blood is subsequently urgently required it can be provided safely following compatibility testing. Blood bank must be informed and a crossmatch request form must be supplied to confirm the request for products.

When a patient has already been transfused the following will apply:

Patient type	Sample type		
	Whole blood at room temperature	Whole blood at 2-8°C	Plasma at -30 °C
Patient transfused or pregnant in last 3 months	Up to 48 hours	Up to 72 hours	N/A
Patient NOT transfused and NOT pregnant in last 3 months	Up to 48 hours	Up to 7 days	Up to 14 days

For procedures likely to require blood transfusion a pre-determined number of units should be requested accordingly to the MSBOS, and should be requested in good time prior to surgery. Cross-match samples for elective surgical cases should be received by 3pm on the day prior to the operation or the Friday if surgery on Monday.

Crossmatched blood will be available in the issue fridge at the QEUH on the morning requested.

At the Victoria ACH, crossmatched blood will be delivered to the Blood Bank refrigerator at Clinic P on the morning requested.

Emergency Crossmatch Requests

During working hours, the transfusion laboratory should be telephoned in advance, and the sample transported to the laboratory immediately by hand and not left to the routine specimen collection. It will be useful if the degree of emergency is indicated e.g., blood required immediately, within one hour, within two hours etc. Out of hours the shift BMS must be contacted by page 17602.

A Trakcare form should be completed, marking the request as urgent. If Trakcare is not available a written request form should be used.

Direct Printing within the Laboratory

TrackCare forms for the following products will print in the lab;

Crossmatch to stored plasma

FFP

Cryo

Platelets

Other products

Crossmatch and Group and Save requests will still print locally as a sample is required for these tests.

The ward/clinical area **MUST** phone the lab to alert them that a form is printing, in case of any printer failure.

Major Haemorrhage

In the event of a major haemorrhage, the switchboard should be contacted by dialling 2222.

The following information should be given:

1. Location of major haemorrhage
2. Extension number to be used by the laboratory staff for contact
3. Name of individual who will act as liaison with the laboratory and will be responsible for taking results/making requests.

The switchboard will contact the laboratory/BMS oncall and the designated porter who will be available for the duration of the emergency.

Group O Rh (D) Negative blood ("flying squad") for emergency is available at the following locations:

QEUH Resus Blood Fridge (Ground Floor)	6 units
QEUH IAU Blood Fridge (Ground Floor)	2 units suitable for paediatric and adult use
QEUH CCU Blood Fridge (Level1)	2 units
Haemobank (Level 2 Theatre Suite)	6 units (minimum)
Maternity Blood Fridge	3 units (1 suitable for paediatric use)
Neurosurgical Blood Fridge	2 units
RHC Theatre Blood Fridge	4 units (all suitable for paediatric use)
Victoria ACH Blood Fridge	6 units

The blood bank must be informed immediately flying squad units are used so that they can be replaced.

In an emergency the blood bank can issue the following:

- Group O Rh (D) Negative – Immediately from fridges as described above
- Group specific blood (after receipt of a crossmatch sample if the patients blood group is known) – available within 15mins
- X-Matched blood – available within 1 hour

Crossmatch Difficulties

Occasional patients may have irregular blood group antibodies. These may have been identified on a previous occasion, in which case the patient may have been issued with an antibody card indicating the identity of the antibody/ies. It may be more difficult to provide compatible blood for these patients and requirements should be discussed with the blood bank. As much warning as possible of planned operations for such patients should be given. In situations where further blood is required for a patient who has already been recently transfused a fresh sample must be sent for crossmatching.

Transfusion Reactions

There are a variety of potential adverse effects of transfusion ranging from acute transfusion reaction with anaphylaxis to potential of transmission of viral infections such as hepatitis and HIV. Any decision to transfuse should therefore take into account both potential benefits and hazards.

Mild transfusion reactions are not uncommon; however severe life-threatening haemolytic reactions are rare. The latter most often are the result of clerical or administrative errors ('mislabelling of specimen/form' or 'patient given the wrong blood').

Acute transfusion reactions can be considered under 3 headings:

1. Haemolytic

These are the result of premature destruction of red cells (usually donor cells) as a consequence of an immune antibody in the recipient. Reactions may be immediate (30-60 mins after starting the transfusion) and dramatic, or delayed up to 2-3 weeks (when the only signs may be mild jaundice and a fall in Hb). Intravascular haemolysis (with complement activation) causes more immediate and severe reactions than extravascular (splenic) haemolysis.

Symptoms

Are variable but, when severe, include throbbing headache, flushing, chest tightness, nausea and lumbar pain. There may be tachycardia, pyrexia, rigors and hypotension.

Haemoglobinuria, DIC and renal failure may develop.

Treatment

Stop transfusion and restore blood volume

Investigations

Notify lab and return all transfused units. Take samples for antibody screen and DCT, repeat crossmatch, FBC, Coag, urinary haemosiderin, U&E, bilirubin and LDH.

2. Non haemolytic febrile transfusion reactions

These are the most commonly encountered transfusion reactions, resulting from HLA, white cell or platelet antibodies already present in the recipient. These are less common following the introduction of universal leucodepletion.

Symptoms

Fever, headache, chills, +/- rigors 30-60 mins after start of transfusion

Treatment

Slow infusion rate (or stop if severe). Consider antipyretics (paracetamol, aspirin).

Investigations

If recurrent, serology for HLA Ab.

3. Urticarial and anaphylactoid reactions

Mild reactions are not uncommon. Severe reactions (wheeze, dyspnoea, collapse and shock) may occur in IgA deficient recipients who have an anti-IgA antibody.

Treatment

Antihistamine, hydrocortisone, adrenaline

Investigations

Test for anti- IgA and IgM antibodies

For further guidance contact a Haematologist or see Handbook of Transfusion Medicine chapter 5. A Transfusion reaction form must be completed and these are available on the departmental intranet page.

Blood Products Available for Issue

1. Red Cell Concentrate

Almost all blood issued for transfusion is in this form. Packs contain approximately 200mls of concentrated red cells from plasma reduced donor units or plasma depleted units where the volume is made up by an optimal additive solution. HCT is approximately 65%. All red cell products in the UK are now leucodepleted.

2. Fresh Frozen Plasma

200-250mls per pack. Used to correct deficiencies of plasma coagulation factors (most commonly in liver disease, massive blood loss and DIC). This is normally issued thawed and ready for use after discussion with a Haematologist and should be given immediately on delivery to the ward/unit. Anyone born after 1st January 1996 should receive Methylene Blue Treated FFP or Octaplas. 4 units of prethawed FFP are kept in the Transfusion Laboratory and are available for immediate use for Trauma and Major Haemorrhage use only.

3. Platelet Concentrates

Used in bleeding due to severe thrombocytopenia or for prophylaxis when platelet count <10 x 10⁹/l. Standard adult dose is approximately 300mls. This product has to be obtained from the Regional Blood Transfusion Centre and has to be ordered via a Haematologist, so there may be some delay in receiving the product. It should be administered immediately on issue to the ward and **must not** be refrigerated.

4. Cryoprecipitate

Approximately 150-200 mls per pack. Used to correct certain specific clotting factor deficiencies or severe hypofibrinogenaemia in DIC. This is normally issued thawed and ready for use after discussion with a haematologist and should be given immediately on delivery to the ward/unit. Anyone born after 1st January 1996 should receive Methylene Blue Treated Cryo.

5. Anti-D Immunoglobulin

Available in various doses and issued dependant on the stage of pregnancy. This will only be issued once the lab confirms that the patient is Rhesus (D) negative.

Specific coagulation factor concentrates and Immunoglobulin preparations are also available and will only be issued after discussion with a haematologist.

Phlebotomy Service

Phlebotomists are available for morning routine venous blood sampling from in-patients in most wards. In order that there is an equitable distribution of this resource on some occasions the phlebotomists may be unable to take all the specimens required for any individual ward and the responsibility will of course remain with the individual doctors to ensure that their own unit's investigations are done. As the phlebotomists commence their duties at 7.30am it is important that the ward doctors have fully completed request forms for the phlebotomists when they attend the wards later on in the morning. It is the responsibility of the phlebotomists to label the specimen containers, but not to complete the request forms. We would ask individual doctors to use their judgement as to whether patients are likely to present great difficulties in relation to sampling and also to draw attention to any relevant complicating medical factors such as bleeding disorder, hazard of infection, etc. There is limited weekend and public holiday phlebotomist provision. Staffing issues, both in phlebotomists and laboratory staff, may cause the service to be capped on occasions.

Haematinics

Haematinic analysis (Serum B12, Serum Folate and Serum Ferritin) is performed by the Biochemistry laboratory at QEUH. The reporting of the results is carried out by Haematology QEUH.

Clinical advice

Clinical advice regarding haematinic results is provided by the haematology department. Please contact the duty haematologist via the hospital switchboard. Any technical queries regarding testing should be directed to the Biochemistry laboratory (0141 354 9025).

Complaints

Complaints regarding the analysis and testing of haematinics should be made by contacting the Biochemistry Quality Manager on 0141 354 9053 (LauraJane.Scott@ggc.scot.nhs.uk)

Complaints regarding clinical information or advice should be made by contacting the Haematology Quality Manager on 0141 354 9093 (Maureen.McBrearty@ggc.scot.nhs.uk)

Urgent samples

Haematinic analysis is not normally performed as an urgent test. The main exception to this is where the patient is suspected of having Macrophage Activation Syndrome. This requires a Ferritin to be performed urgently and this should be authorised by the duty haematologist out of hours.

Reference Ranges

Please see table on page 19

Turnaround times

Please see table on page 13

Uncertainty of Measurement

Please see table on page 27

Bone Marrow analysis

Bone Marrow processing (Aspirate and Trepine) is performed by the Pathology laboratory at QEUH. The reporting of the results is carried out by Haematology QEUH.

Clinical advice

Clinical advice regarding bone marrow results is provided by the haematology department. Please contact the duty haematologist via the hospital switchboard. Any technical queries regarding processing should be directed to the Pathology laboratory (0141 354 9514).

Complaints

Complaints regarding the processing of bone marrow samples should be made by contacting the Pathology Compliance Manager on 0141 354 9461 (Steve.Connell@ggc.scot.nhs.uk)

Complaints regarding clinical information or advice should be made by contacting the Haematology Quality Manager on 0141 354 9093 (Maureen.McBrearty@ggc.scot.nhs.uk)

Turnaround times

Please see table on page 13

Tests Sent to other locations

TEST	HOSPITAL	TRANSPORT	SAMPLES	Turnaround Times
Anticardiolipin	Haemostasis, McEwan Building, GRI	Van	2x Citrate	2 week2
Cell Markers	Haematology, Gartnavel	Van	EDTA / Marrow (+ 3 slides)	24 hours
Erythropoietin	Biochemistry, McEwan Building GRI	Van	Heparin	1 week
Factor V Leiden	Haemostasis, McEwan Building, GRI	Van	1 x Citrate	4 weeks
Granulocyte Immunology	NHSBT Centre, 500 North Bristol Park, Northway, Filton Bristol, BS34 7QH	Mail	2 X SST	28 days
HLA B27	Histocompatibility & Immunogenetics, Gartnavel General Hospital	Van	EDTA	1 week
Lupus Screen	Haemostasis, McEwan Building, GRI	Van	2 x Citrate	2 weeks
ADAMTS 13- By arrangement	Haemostasis, McEwan Building, GRI	Van	2 x Citrate	24 hours
HIT Screen- By arrangement	Haemostasis, McEwan Building, GRI	Van	1 x Citrate	24 hours
Adult patients- Intrinsic Screen	Haemostasis, McEwan Building, GRI	Van	2 x Citrate	1 week
Adult patients- Extrinsic Screen	Haemostasis, McEwan Building, GRI	Van	2 x Citrate	2 weeks
All adult Factor assays	Haemostasis, McEwan Building, GRI	Van	1 x Citrate	Mon- Fri next working day. Otherwise 24 hrs by arrangement
Von willebrands Screen- Antigen	Haemostasis, McEwan Building,	Van	2 X Citrate	2 weeks

and RiCof Assay	GRI			
Fibrinogen antigen	Haemostasis, McEwan Building, GRI	Van	1 x Citrate	2 weeks
Anti Xa assays for Fondaparinux, Danaparoid (Orgaran) Rivaroxiban, Apixiban and Edoxaban	Haemostasis, McEwan Building, GRI	Van	1 x Citrate	24 hours by arrangement, otherwise next working day (Mon-Fri 9-5)
PNH	Haematology, Gartnavel	Van	EDTA	24 hours
Prothrombin Gene	Haemostasis, McEwan Building, GRI	Van	1 x Citrate	2 weeks
Thrombophilia Screen	Haemostasis, McEwan Building, GRI	Van	4 x Citrate	1 week
Factor XIII	Haemostasis, McEwan Building GRI	van	1x Citrate	2 weeks
Platelet Nucleotides	Haemostasis Department, Royal Infirmary of Edinburgh	Courier	4 x Citrate	1 week
Haemophilia/VWF Genetics	Haemostasis Department, Royal Infirmary of Edinburgh	First Class Post	EDTA	
vWF Multimer Analysis	Haemostasis Department, Royal Infirmary of Edinburgh	First Class Post	EDTA	

Blood Transfusion Tests Sent to other locations

TEST	HOSPITAL	TRANSPORT	SAMPLES	Turnaround Times
Antibody Investigation	Clinical Services West of Scotland B.T.S 25 Shelley Road Glasgow, G12 OXB	Taxi	2 x 6mls Pink Top	3 Hours - 5 Days
Cross Matching			2 x 6mls Pink Top	1 - 4Hrs
Platelet allo-antibody Screening			2 x 6ml Transfusion EDTA	24Hrs Verbal

Platelet Auto-Antibody Screening			1-8 x (FBC) EDTA (depends on platelet count)	24Hrs Verbal
Anti-D Quantitation			2 x 6mls Pink Top	Same Day Verbal
FMH by Flow Cytometry			2 x 6mls Pink Top	Within 24 Hrs

Measurement of Uncertainty

Uncertainty of measurement is the doubt that exists about the result of any measurement. By quantifying the possible spread of measurements, we can say how confident we are about the result. A measurement result is only complete when accompanied by a statement of its uncertainty. A statement of uncertainty is required in order to decide if the result is adequate for its intended purpose and consistent with other similar results. It does not matter how accurate a measuring instrument is considered to be the measurements made will always be subject to a certain amount of **uncertainty**. Below is the calculated Uncertainty of Measurement values for each test at the various clinical ranges, based on a study carried out in December 2020.

Calculated Uncertainty of Measurement Values

Haematology

Date performed: December 2020

General Haematology				
TEST	MEAN	UNIT	MEASURED UNCERTAINTY	UNCERTAINTY RANGE
WBC	3.01	x10 ⁹ /l	+/- 0.07	2.62-3.4
WBC	7.15	x10 ⁹ /l	+/- 0.12	6.27 – 8.04
WBC	16.5	x10 ⁹ /l	+/- 0.23	14.48-18.51
HGB	54	g/l	+/- 0.6	52 – 57
HGB	110	g/l	+/- 0.9	106 – 113
HGB	153	g/l	+/- 1.1	148 – 158
RBC	2.32	x10 ¹² /l	+/- 0.03	2.20 – 2.43
RBC	4.26	x10 ¹² /l	+/- 0.04	4.11 – 4.41
RBC	4.92	x10 ¹² /l	+/- 0.04	4.75 – 5.09
HCT	0.164	l/l	+/- 0.003	0.152 – 0.176
HCT	0.328	l/l	+/- 0.006	0.306 – 0.350
HCT	0.436	l/l	+/- 0.006	0.410 – 0.462
MCV	70.2	fl	+/- 1.0	66.4 – 74.7
MCV	76.4	fl	+/- 1.1	71.9 – 80.9

MCV	88.1	fl	+/- 0.9	84.5 – 91.7
MCH	24.1	pg	+/- 0.24	22.9– 25.3
MCH	25.8	pg	+/- 0.24	24.8 – 26.8
MCH	31.2	pg	+/- 0.26	29.9 – 32.4
MCHC	333	g/l	+/- 6.0	310 – 356
MCHC	337	g/l	+/- 5.4	315 – 359
MCHC	351	g/l	+/- 4.4	331 – 370
PLT	95	x10 ⁹ /l	+/- 3.0	84 – 105
PLT	245	x10 ⁹ /l	+/- 5.0	223 – 267
PLT	533	x10 ⁹ /l	+/- 8.0	498 – 565
NEU	1.12	x10 ⁹ /l	+/- 0.04	0.96 – 1.28
NEU	2.92	x10 ⁹ /l	+/- 0.08	2.62 – 3.21
NEU	6.95	x10 ⁹ /l	+/- 0.17	6.24 – 7.66
LYM	0.98	x10 ⁹ /l	+/- 0.05	0.78 – 1.18
LYM	2.09	x10 ⁹ /l	+/- 0.08	1.66 – 2.52
LYM	4.61	x10 ⁹ /l	+/- 0.12	3.86 – 5.37
MON	0.37	x10 ⁹ /l	+/- 0.04	0.22 – 0.52
MON	0.90	x10 ⁹ /l	+/- 0.07	0.62 – 1.18
MON	1.96	x10 ⁹ /l	+/- 0.10	1.49 – 2.42
EOS	0.28	x10 ⁹ /l	+/- 0.02	0.2 – 0.35
EOS	0.72	x10 ⁹ /l	+/- 0.05	0.56 – 0.88
EOS	1.69	x10 ⁹ /l	+/- 0.12	1.21 – 2.16
BAS	0.15	x10 ⁹ /l	+/- 0.01	0.11 – 0.19
BAS	0.39	x10 ⁹ /l	+/- 0.02	0.29 – 0.49
BAS	0.91	x10 ⁹ /l	+/- 0.03	0.66 – 1.16
RET	140.0	x10 ⁹ /l	+/- 3.8	123.7 – 156.4
RET	108.5	x10 ⁹ /l	+/- 3.6	94.7 – 121.7
RET	53.8	x10 ⁹ /l	+/- 2.4	45.6 – 62.5
ESR	5.5	mm/hr	+/- 0.4	5 - 6
ESR	43	mm/hr	+/- 1.5	39 - 45
PV	4.06	mPas	+/- 0.16	2.06 – 8.62

Manual Differential				
TEST	MEAN	UNIT	MEASURED UNCERTAINTY	UNCERTAINTY RANGE
NEU	50.4	%	+/- 3.9	19 - 98
LYM	40.5	%	+/- 3.7	1 - 63
MON	6.2	%	+/- 3.2	1 – 16
EOS	2.4	%	+/- 1.3	0 – 7
BAS	0.2	%	+/- 0.3	0 - 2

Kleihauer				
TEST	MEAN	UNIT	MEASURED UNCERTAINTY	UNCERTAINTY RANGE
2 ml bleed	2.8	ml bleed	+/- 0.8	1.8 – 3.8
4 ml bleed	5.4	ml bleed	+/- 1.0	3.6 – 6.2
8 ml bleed	7.7	ml bleed	+/- 1.3	6.1 – 9.4

All Kleihauer results around the clinical decision value are sent for quantification by flow cytometry.

Haemoglobinopathy Date performed: December 2020

Haemoglobinopathy				
TEST	MEAN	UNIT	MEASURED UNCERTAINTY	UNCERTAINTY RANGE
HbA2	2.6	%	+/- 0.1	2.5 – 2.7
HbA2	6.0	%	+/- 0.6	5.9 – 6.1*
HbF	2.05	%	+/- 0.1	2.0 – 2.1
HbF	9.7	%	+/- 0.3	9.6 – 9.8
Hb S variant	27.3	%	+/- 0.7	25.1 – 28.1

*Within the HbA2 range of 5.9-6.1%, the uncertainty value includes the variance of target value and measured value of the NIBSC reference material.

Haemostasis Date performed: December 2020

Haemostasis				
TEST	MEAN	UNIT	MEASURED UNCERTAINTY	UNCERTAINTY RANGE
PT	12.8	secs	+/- 0.3	10.9 – 12.6
PT	22.3	secs	+/- 0.7	20.7 – 23.8
APTT	30.4	secs	+/- 0.7	28.4 – 32.5
APTT	42.4	secs	+/- 0.9	40.0 – 44.7
TCT	13.5	secs	+/- 0.8	12.1 – 14.9
TCT	16.5	secs	+/- 0.9	15.0 – 17.9
FIB	3.11	g/l	+/- 0.2	2.75 – 3.47
FIB	1.95	g/l	+/- 0.15	1.65 – 2.25
D-Dimer	278	ng/ml	+/- 12	244 - 311
D-Dimer	582	ng/ml	+/- 20	524 – 639
FII	102	iu/dl	+/- 5.8	90 – 113
FII	31	iu/dl	+/- 1.6	28 - 34
FV	98	iu/dl	+/- 4.5	92 - 104
FV	29	iu/dl	+/- 2.0	26 - 32

FVII	81	iu/dl	+/- 7.0	70 - 92
FVII	23	iu/dl	+/- 2.8	17 - 29
FVIII	86	iu/dl	+/- 9.9	74 - 98
FVIII	27	iu/dl	+/- 2.0	24 - 30
FIX	107	iu/dl	+/- 7.5	95 - 119
FIX	30	iu/dl	+/- 1.5	27 - 33
FX	102	iu/dl	+/- 3.0	98 - 106
FX	26	iu/dl	+/- 0.7	25 - 27
FXI	90	iu/dl	+/- 5.0	80 - 100
FXI	26	iu/dl	+/- 1.5	24 - 28
FXII	79	iu/dl	+/- 4.2	73 - 87
FXII	28	iu/dl	+/- 1.1	26 - 30
vWFAg	108	iu/dl	+/- 3.2	102 - 114
vWFAg	34	iu/dl	+/- 1.0	32 - 36
Ricof	104	iu/dl	+/- 2.5	100 - 108
Ricof	34	iu/dl	+/- 1.6	31 - 37

Factor assays – all factors assays have not achieved the minimum uncertainty goals. This is in part due to the small number of observations included in the statistics. Therefore analytical performance has been assessed to determine fitness for purpose. All IQC and EQA perform well for all factor assays within the given ranges.

UKAS Accreditation

The laboratory's UKAS accredited test repertoire can be found on the UKAS Website via this hyperlink:

[UKAS ACCREDITATION](#)