Title: BSL Haematology and Haemostasis User Handbook

Document No: LP-BS-HA009

Version number 2

Review interval 2 years

Author Vassan Thavarajah

Authorised by Volha Klimovich

Effective date 04/10/2022

Review date 04/10/2024

Department BSL Haematology and Haemostasis

Version Number	Change Details	Date
2	Referral tests indicated as appropriate (section3)	30/09/2022
2	New Reference ranges included	30/09/2022
2	Changed Viapath name to Synnovis	30/09/2022

Contents

1. Introduction

1.1 General Information

King's College Hospital was originally opened in 1840 and moved to the Denmark Hill site in 1909. It became part of the NHS in 1948 as a teaching hospital. Following the dissolution of South London Healthcare Trust, King's took over the Princess Royal University Hospital (PRUH) in October 2013.

King's College Hospital NHS Foundation Trust is a large provider of acute and specialist services that serves a population of over 1,000,000 in the economically diverse Greater London boroughs of Southwark, Lambeth, Bromley and Bexley. The trust operates from 5 sites; Denmark Hill (main) site, Princess Royal University Hospital (PRUH) Bromley, Beckenham Hospital, Queen Mary's Hospital Sidcup and Orpington Hospital. The PRUH is in Farnborough, near Orpington, Kent. Beckenham Hospital is about 6 miles to the north of the PRUH and provides outpatient services. Orpington Hospital is 3 miles south of PRUH, provides outpatient services, and has 40 intermediate care beds.

The Trust has over 1300 beds including 1050 acute, 125 maternity and 144 critical care beds. The Denmark Hill site has approximately 836 beds including a major critical care service (122 beds) and maternity services (103 beds). Princess Royal University Hospital has 455 acute beds, 22 critical care and 22 maternity beds (and a midwifery led birthing centre) whilst Orpington provides 29 acute beds. Emergency Department services are provided at both King's College Hospital Denmark Hill and Princess Royal University Hospital.

All core services are provided from King's College Hospital Denmark Hill and Princess Royal University Hospital while outpatient and surgical services are provided from Orpington Hospital.

The Haematology laboratories are accredited to ISO 15189:2012 Standard by the United Kingdom Accreditation Service (UKAS).

Each department undergoes regular assessments by UKAS to demonstrate that the quality system in place provides a service that meets recognised quality standards (ISO 15189:2012 Standard).

The Blood Sciences Laboratory (BSL) at King's Denmark Hill (DH) undertake routine Haematology & Haemostasis, aswell as some Specialist Haemostasis investigations, which include full blood counts, clotting, malaria diagnosis, factors assays, thrombophilia tests.

A list of BSL Haematology accredited tests can be found on our schedule of accreditation available on the UKAS website. Copy and paste the link below into your search engine for DH:

https://www.ukas.com/wp-content/uploads/schedule_uploads/00007/9092%20Medical%20Single.pdf

The list can also be found by entering the department's accreditation number (9092 - DH) in the search bar of the UKAS website https://www.ukas.com/search-accredited-organisations

This Handbook includes information on:

- Contact details for key staff
- Service levels and hours of operation
- Location of services
- Types of investigation offered
- Types of specimens required and collection conditions.
- Instructions for collecting specimens with a particular emphasis on safety and maintenance of sample validity

Should any service user have any queries in connection with any aspect of the BSL Haematology service, contact should be made with the relevant departmental senior staff, the Operations Manager, Service Delivery Manager or the Departments Quality Manager.

This Haematology User Handbook should be user-friendly and intuitive. Suggestions for improving the content for the next edition are welcome.

1.2 Pathology Laboratory

The Blood Sciences Laboratory department includes the following specialties: -

Blood Sciences:

- Biochemistry
- Haematology / Haemostasis
- Blood Transfusion

Access to all areas of the Blood Sciences department is restricted to authorised staff only. All entrances into the department are secured by digi-lock or proximity pass access.

The department operates in compliance with the standards laid out by ISO 15189:2012.

The laboratories are registered for training with the Institute of Biomedical Sciences (IBMS).

- The qualified health professionals (Biomedical Scientists) employed in the department are registered with the Health Professions Council (HCPC) meeting the standards for their respective training, professional skills, behaviour and health.
- **Clinical advice** and interpretation of results is available during the laboratory routine opening hours.
- **Clinical advice (out of hours)** - contact details and access to clinical advice out-of-hours is listed.

1.3 Key personnel and contact details

For Denmark Hill switchboard dial 020 3299 9000.

For OOH Clinical Advice Haematology Registrar is contactable via the main switch board number above or Lab Specialist Registrar ext 32435, bleep no. 737*KH3080.

Clinical Lead		
Professor R Arya		
Haematology BSL Laboratory – Denmark Hill site		
Name	**Designation**	**Contact details**
Ian Roney	Service Delivery Manager	31687 ian.roney@nhs.net
Vassan Thavarajah	BSL Haematology & Haemostasis Operations Manager	31659 vassan.thavarajah@nhs.net
Volha Klimovich	Quality Manager	3 v.klimovich@nhs.net

Postal addresses:

BSL Haematology & Haemostasis Department
King's College Hospital NHS Foundation Trust
Ground Floor, Bessemer Wing
Denmark Hill
London
SE5 9RS

2. Laboratory Service

The department provides a wide range of analytical services for diagnosis, monitoring, screening and follow-up of patients. Clinically qualified members of the laboratory are available on-site during normal working hours (and by air-call at other times).
Successful laboratory diagnosis depends greatly upon the selection, timing and method of collection of specimens.

Medical staff are urged to discuss with Senior Blood Science staff members any problem regarding the choice of investigation, the nature and method of specimen collection and interpretation of results.

2.1 Normal laboratory opening times

Monday - Friday: 09:00 – 17:30

The Central Specimen reception is open 24h and 7 days a week for specimen drop off.

2.2 Out of hours service (Including Bank Holidays)

The out of hours service runs outside of the routine lab hours listed above. At least one Biomedical Scientist (BMS) is on at all times and should be contacted on

0203 299 6216

Tests offered include those in section 3 below.

Clinical advice out of hours can be obtained from the Lab Specialist Registrar who can be contacted through the Hospital switchboard.

Specialist investigations may be available following discussions between the requesting clinician and a senior member of the laboratory team.

3. Use of the Laboratory

3.1 Patient Identification and Specimen Labelling

Either an EPR-based or a paper-based request must accompany all specimens sent to the laboratory. It should clearly state the following information. Those in bold are a minimum requirement and without them the sample could be discarded or delayed:

- **Patient name**
- **Hospital number/NHS number**
- **Date of birth (age if DOB not known)**
- **Sex**
- **Ward or Address for report**
- **Requesting Medical Officer/GP name and number**
- **Date and time specimen taken**
- **Tests required**

Other useful data:

- Contact number for requesting clinician
- Patient address
- All relevant clinical details.

It is the responsibility of the person collecting the sample to ensure it is correctly labelled.

Under no circumstances is it possible to change the details once the sample has been sent to the laboratory.

The following will be rejected:

- Unlabelled specimens
- Inadequate patient information
- Mismatched samples and forms
- Grossly leaking specimens

Specimens are accepted only when they are correctly labelled and collected as per instructions provided within this Guide and other related policies to ensure validity of the results.

The Haematology department will strictly enforce this policy. The requested analyses will **NOT** be performed on any samples where there is any discrepancy with patient identification.

3.2 Urgent tests

All urgent requests for routine blood tests that are performed in-house will be reported within 1 hour of receipt of the specimen into the laboratory. Other specialist assays be prioritised if there is a valid clinical indication, please contact the Operations Manager for Haematology & Haemostasis to discuss individual cases.

3.3 Transportation of Specimens

Samples must be delivered to the department in a way to protect the integrity of the sample. Samples must not be exposed to extreme temperature or prolonged transport. If samples are in danger of being exposed to conditions where sample integrity can be compromised, please contact the laboratory to discuss the most appropriate method of transport.

When receiving samples from an external institution or laboratory, it is the responsibility of the sender to ensure that the samples are packed in accordance with the current postal regulations, contain appropriate paper work and are labelled correctly. Courier / taxi / suitable transport should be arranged by the sending institution or laboratory.

All pathological samples must have:

3.3.1 Primary receptacle

Primary receptacle - a primary watertight leak-proof receptacle containing the specimen. The receptacle must be packaged with enough absorbent material to absorb all fluid in case of breakage.

3.3.2 Secondary packaging

- Secondary packaging - a second durable, watertight, leak-proof packaging to enclose and protect the primary receptacle(s) i.e. the specimen bag
- All samples must be placed in individual plastic 'kangaroo' type sample bags to avoid cross contamination. Any documentation e.g. request forms are to be placed in the separate pocket on the outside of the bag.
- Bags must not be sealed using staples, pins or paperclips.

- Several cushioned primary receptacles may be placed in one secondary packaging, but sufficient additional absorbent material shall be used to absorb all fluid in case of breakage.

3.3.3 Outer packaging

The secondary packaging is placed in outer shipping packaging with suitable cushioning material. Outer packaging protects contents from outside influences, such as physical damage, while in transit.

- For postal specimens this will be a UN3373 box
- For cross-site or GP transport this will be a Daniels box

Any specimens that are received leaking or in a dangerous condition will not be processed but will be discarded. In this event the clinician will be informed via a report generated electronically on the pathology computer system.

3.4 Transport of specimens by road

The transport of most specimens from the General Practitioner's surgeries or outreach clinics to the hospital laboratory is provided by designated Courier service providers who will be familiar with their responsibilities.

If for any reason, pathological samples have to be transported via a contracted transport supplier, the following guidelines must be adhered to,

- The box must not be transported in the same compartment as passengers – but must be placed in the boot of any vehicle or the rear compartment of any van used and firmly secured.
- Mail must not be transported in the same carrier box as specimens.
- The container must be secured using appropriate means whilst being transported in the vehicle.
- Specimens must be transported in a secure transport box with a fastened leak proof lid. (Compliant with IATA Packaging Instruction 650 or 621 and UN3373 or UN3291)

It is the responsibility of those sending specimens from locations within the Trust but outside the laboratory site that the correct procedures are observed and that they obtain and utilise the approved and correctly labelled transport boxes.

Each box must display a biohazard warning sign and must also state that the box must not be tampered with or opened and a telephone contact number included for emergency purposes.

Carriage of pathological specimens between hospitals and/ or GP clinics and the hospital by road comes under the remit of 'The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009, as amended (CDG Regs)' – ADR regulations.

3.5 List of examinations performed in KCH BSL Haematology & Haemostasis.

3.5.1 Any tests referred to other laboratories or external sites indicated within additional test information column and listed under section 5.2.

Test	Additional Test Information	Sample type	Minimum Sample	Turnaround Time		Time limit for Add on tests
				Urgent	Routine	
ADAMTS-13 Activity	**NOTE:** This is a Referral test. Inform the laboratory BMS in advance on **Ext.32434** During out of hours ensure to telephone **Ext. 32616** Adequately filled sample sent to lab within an hour of clean venepuncture.	SST Serum/ Tri-sodium citrate/blue top tube	**1 x 3mL** STT Or **1 x 3mL** citrate	**24** HOURS	**7** DAYS	Discuss with laboratory on **Ext. 32434**
ADAMTS-13 Inhibitor						
Anti-Xa (Unfractionated Heparin)	Adequately filled samples to be hand delivered directly to the Bessemer Wing Blood Sciences Central Specimen Reception Immediately after clean venepuncture.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**60** MINUTES	**N/A**	Within 1 hour of sample collection.
Anti-Xa (Enoxaparin)	Adequately filled sample sent to lab within an hour of clean venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result. Such samples will be rejected.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**60** MINUTES	**4-6** HOURS	Within 4 hours of sample collection
Anti-Xa (Tinzaparin)						
Anti-Xa (Dalteparin)						
Anti-Xa (Rivaroxaban)	Adequately filled sample sent to lab within an hour of clean venepuncture.		**1 x 3mL**	**60** MINUTES	**4-6** HOURS	Within

Test	Additional Test Information	Sample type	Minimum Sample	Turnaround Time		Time limit for Add on tests
				Urgent	Routine	
Anti-Xa (Apixaban)	Clots of any size, haemolysis, underfilling or overfilling will affect result. Such samples will be rejected.	Tri-sodium citrate/blue top tube				4 hours of sample collection
Anti-Xa (Edoxaban)						
Anti-IIa (Dabigatran)	Adequately filled sample sent to lab within an hour of clean venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result. Such samples will be rejected.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**60** MINUTES	**4-6** HOURS	Within 4 hours of sample collection
Antithrombin Activity	Adequately filled sample sent to lab within an hour of clean venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result. Such samples will be rejected.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**90** MINUTES	**7** Days	Within 4 hours of sample collection
Antithrombin Antigen			**1 x 3mL**	**N/A**	**14** DAYS	
Blood Film	Full Blood Count required for interpretation. Any patient suspected to have cold agglutinins must have their sample kept at 37°C and brought to the laboratory immediately (Blood Sciences Laboratory- Haematology)	EDTA (K2 Type Only)	**1 x 4mL**	**2** HOURS	**24 – 48** HOURS	Within 24 hours of sample collection

Test	Additional Test Information	Sample type	Minimum Sample	Turnaround Time		Time limit for Add on tests
				Urgent	Routine	
Clauss Fibrinogen	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result. Such samples will be rejected.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**60** MINUTES	**4** HOURS **6** HOURS Outpatients/ GPs	Within 4 hours of sample collection
COAGULATION SCREEN **PT/INR** **aPTT/aPTT ratio**	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result. Such samples will be rejected.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**60** MINUTES	**4** HOURS **6** HOURS Outpatients/ GPs	Within 4 hours of sample collection
Correction Studies PT and aPTT 50:50 Mixing studies	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**90** MINUTES	**4** HOURS **6** HOURS Outpatients/ GPs	Within 4 hours of sample collection
D-Dimer	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**60** MINUTES	**4** HOURS **6** HOURS Outpatients/ GPs	Within 4 hours of sample collection

Test	Additional Test Information	Sample type	Minimum Sample	Turnaround Time		Time limit for Add on tests
				Urgent	Routine	
ESR		EDTA (K2 Type Only)	**1 x 4mL**	**120** MINUTES	**4** HOURS **6** HOURS Outpatients/ GPs	Within 24 hours of sample collection
Full Blood Count	Any patient suspected to have cold agglutinins must have their sample kept at 37°C and brought directly to the laboratory (Blood Sciences Laboratory at Bessemer Wing) immediately.	EDTA (K2 Type Only)	**1 x 4mL**	**60** MINUTES	**4** HOURS **6** HOURS Outpatients/ GPs	Within 24 hours of sample collection
FII	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result. Such samples will be rejected.	Tri-sodium citrate/blue top tube	**1 x 3mL** **3 x 3mL** For multiple factors	**2** HOURS	**3** DAYS	Within 4 hours of sample collection
FV						
FVII						
FX						
FVIII						
FIX						
FXI						
FXII						

Test	Additional Test Information	Sample type	Minimum Sample	Turnaround Time		Time limit for Add on tests
				Urgent	Routine	
FXIII	**NOTE:** This is a Referral test. Adequately filled sample with no clots to be sent to lab within an hour of venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result. Such samples will be rejected.	Tri-sodium citrate/blue top tube	**1 x 3mL**	N/A	**14** DAYS	Within 4 hours of sample collection
FVIII (Chromogenic Assay)	**NOTE:** This is a Referral test. Adequately filled sample with no clots to be sent to lab within an hour of venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result. Such samples will be rejected.	Tri-sodium citrate/blue top tube	**1 x 3mL** **3 x 3mL** For Full vWF Screen	**2** HOURS	**3** DAYS	Within 4 hours of sample collection

Test	Additional Test Information	Sample type	Minimum Sample	Turnaround Time		Time limit for Add on tests
				Urgent	Routine	
Glandular Fever (GF)	Negative result cannot completely rule out the possibility of Infectious Mononucleosis, as antibodies may be absent or present at too low a level to be detected. Other conditions can cause a positive result. Test should only be used for symptomatic individuals suspected of having IM and should be used for diagnosis only in conjunction with other clinical findings. Blood Film also performed with every request.	EDTA (K2 Type Only)	**1 x 4mL**	**2** HOURS	**48** HOURS	Within 24 hours of sample collection
HIT Screen	**NOTE:** This is a Referral test. Inform the laboratory in advance on **Ext.32434** During out of hours ensure to telephone **Ext. 32616**	SST Serum. Or Tri-sodium citrate/blue top tube	**1x 3mL SST** Or **1 x 3mL Citrate**	**24** HOURS	**N/A**	Within 4 hours of sample collection
INR (Warfarin)	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**60** MINUTES	**4** HOURS **6** HOURS Outpatients/ GPs	Within 4 hours of sample collection

Test	Additional Test Information	Sample type	Minimum Sample	Turnaround Time		Time limit for Add on tests
				Urgent	Routine	
Lupus Anticoagulant Test (DRVVT & dAPTT)	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture.	Tri-sodium citrate/blue top tube	**3 x 3mL**	**24** HOURS	**7** DAYS	Within 4 hours of sample collection
Lupus Anticoagulant Test (TSVT)	**NOTE:** This is a Referral test.					
Malaria Screen	Sample preferably taken at height of fever. Must state travel history, symptoms & any therapy when requesting this test. Analysed in Blood Sciences Laboratory- Haematology. **NOTE:** ALL first time positive malaria results also referred to Malaria Reference Laboratory in London for confirmation.		**1 x 4mL**	**2** HOURS	**N/A**	Contact laboratory on **Ext. 32418**
Platelet Function Test	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture	Tri-sodium citrate/blue top tube	**1 x 3mL**	**120** MINUTES	**4** HOURS **6** HOURS Outpatients/ GPs	Contact laboratory on **Ext. 32434**
Protein C Activity	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture	Tri-sodium citrate/blue top tube	**1 x 3mL**	**90** MINUTES	**7** DAYS	Contact laboratory on **Ext. 32434**

Test	Additional Test Information	Sample type	Minimum Sample	Turnaround Time		Time limit for Add on tests
				Urgent	Routine	
Protein C Antigen	**NOTE:** This is a Referral test.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**N/A**	**14** DAYS	Contact laboratory on **Ext. 32434**
Free Protein S Antigen	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture	Tri-sodium citrate/blue top tube	**1 x 3mL**	**90** MINUTES	**7** DAYS	Contact laboratory on **Ext. 32434**
Protein S Functional Assay	**NOTE:** This is a Referral test.	Tri-sodium citrate/blue top tube	**1 x 3mL**	**90** MINUTES	**7** DAYS	Contact laboratory on **Ext. 32434**
Reticulocytes	Any patient suspected to have cold agglutinins must have their sample kept at 37°C and brought directly to the Haematology laboratory within Blood Sciences Laboratory at Bessemer Wing) immediately.	EDTA (K2 Type Only)	**1 x 4mL**	**60** MINUTES	**4** HOURS **6** HOURS Outpatients/ GPs	Within 24 hours of sample collection
Thrombin Time	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture	Tri-sodium citrate/blue top tube	**1 x 3mL**	**60** MINUTES	**4** HOURS **6** HOURS Outpatients/ GPs	Within 4 hours of sample collection

Test	Additional Test Information	Sample type	Minimum Sample	Turnaround Time		Time limit for Add on tests
				Urgent	Routine	
VWF: GPIbR Activity	**NOTE:** This is a Referral test. Adequately filled sample with no clots to be sent to lab within an hour of venepuncture. Clots of any size, haemolysis, underfilling or overfilling will affect result. Such samples will be rejected.	Tri-sodium citrate/blue top tube	**1 x 3mL** **3 x 3mL** For Full vWF Screen	**2** HOURS	**3** DAYS	Within 4 hours of sample collection
VWF: Antigen	Adequately filled sample with no clots to be sent to lab within an hour of venepuncture.					

3.6 Turnaround times

Urgent	Within **1 hours** of receipt.
Inpatient	Within **4 hours** of receipt.
GP, outpatient and external locations	Within **6 hours** of receipt.

All turnaround times stated are for tests performed on-site.

3.7 Add on tests.

Add-on for tests accepted within specified timeframes according to sample stability. Add on are handled by the laboratory BMS, who can advise when this is not appropriate.

Haematology 0203 299 9000 ext 32418 M-F 09:00 – 17:30

Haemostasis 0203 299 9000 ext 32434 M-F 09:00 – 17:30

For OOH phone the oncall number 0203 299 6216 for both sections

If an add-on is required urgently, a separate sample may be required.

4. Referral Laboratories used by this Laboratory

- Malaria Reference Laboratory at The London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT (UKAS accredited) - Malaria confirmation
- Haemostasis Laboratory, GSTS Pathology, 5th floor, North Wing, St. Thomas Hospital, Westminister Bridge Road, SE1 7EH (UKAS accredited)

5. Referral tests

5.1.1 ADAMTS-13 Activity
5.1.2 ADAMTS-13 Inhibitor
5.1.3 Antithrombin Antigen
5.1.4 FVIII (Chromogenic Assay)
5.1.5 HIT Screen
5.1.6 Lupus Anticoagulant Test (TSVT)
5.1.7 Malaria Confirmation (Thick Film/PCR)
5.1.8 Protein C Antigen
5.1.9 Protein S Functional Assay
5.1.10 VWF: GPIbR Activity

6. Reference Ranges for Haematology Tests performed at Kings College Hospitals.

Adults Ranges (>12 years of age) for Routine Haematology Tests determined locally in March 2020 and reviewed with KCH Haematology clinical lead (Prof R Arya).

Ranges provided for age range (0-12 years full term) taken from publication by Barbara J. Bain - Dacie and Lewis Practical Haematology- 12th ed. 2017 pages 12- 13.

Test	Age Range	Reference Range		Units
		Lower Limit	Upper Limit	
White blood cell count	D0–D3	10.00	26.00	x10^9/L
	D4–1M	8.00	23.00	
	1M–2M	5.00	19.00	
	2M–3M	5.00	15.00	
	3M-1Y	6.00	18.00	
	1Y–2Y	6.00	16.00	
	2Y–6Y	5.00	15.00	
	6Y–12Y	5.00	13.00	
	>12Y	4.00	11.00	
Red Blood Cell Count	D0 to D3	5.00	7.00	x10^12/L
	D4–1M	4.00	6.60	
	1M–2M	3.00	5.40	
	2M–3M	3.10	4.30	
	3M-1Y	4.10	5.30	
	1Y–2Y	3.90	5.10	
	2Y–6Y	4.00	5.20	
	6Y–12Y	4.00	5.20	
	>12Y (Male)	4.50	5.80	
	>12Y (Female)	3.80	5.80	
Haemoglobin	D0–D3	140	220	g/L
	D4–1M	150	210	
	1M–2M	115	165	
	2M–3M	100	130	
	3M-1Y	111	141	
	1Y–2Y	111	141	
	2Y–6Y	110	140	
	6Y–12Y	115	155	
	>12Y (Male)	130	165	
	>12Y (Female)	115	155	

Test	Age Range	Reference Range		Reporting Units
		Lower Limit	Upper Limit	
Haematocrit	D0–D3	0.585	0.615	L/L
	D4–1M	0.595	0.617	
	1M–2M	0.420	0.440	
	2M–3M	0.280	0.420	
	3M-1Y	0.345	0.400	
	1Y–2Y	0.300	0.380	
	2Y–6Y	0.340	0.400	
	6Y–12Y	0.350	0.450	
	>12Y (Male)	0.400	0.540	
	>12Y (Female)	0.370	0.470	
Mean Cell Volume	D0–D3	100	120	fL
	D4–1M	92	118	
	1M–2M	92	116	
	2M–3M	87	103	
	3M-1Y	68	84	
	1Y–2Y	72	84	
	2Y–6Y	75	87	
	6Y–12Y	77	95	
	>12Y	77.0	100.0	
Mean cell Concentration	D0–D3	31.0	37.0	pg
	D4–1M	31.0	37.0	
	1M–2M	30.0	36.0	
	2M–3M	27.0	33.0	
	3M-1Y	24.0	30.0	
	1Y–2Y	25.0	29.0	
	2Y–6Y	25.0	30.0	
	6Y–12Y	25.0	33.0	
	>12Y	25.0	34.0	

Test	Age Range	Reference Range		Reporting Units
		Lower Limit	Upper Limit	
Red Cell Distribution Width	>12Y (Male/Female)	11.0	15.0	%
Mean Cell Haemoglobin Concentration	D0–D3	300	360	g/L
	D4–1M	290	360	
	1M–2M	290	360	
	2M–3M	285	355	
	3M-1Y	300	360	
	1Y–2Y	320	360	
	2Y–6Y	310	370	
	6Y–12Y	310	370	
	>12Y	304	360	
Platelet Count	D0–D3	150	450	10^9/L
	D4–1M	210	500	
	1M–2M	200	500	
	2M–3M	210	650	
	3M-1Y	200	550	
	1Y–2Y	200	550	
	2Y–6Y	200	450	
	6Y–12Y	180	400	
	>12Y	150	450	

Mean Platelet Volume	>12Y (Male/Female)	9.1	12.8	fL

Test	Age Range	Reference Range		Reporting Units
		Lower Limit	Upper Limit	
Neutrophil Count	D0–D3	4.0	14.0	x10^9/L
	D4–1M	3.0	5.0	
	1M–2M	3.0	9.0	
	2M–3M	1.0	5.0	
	3M-1Y	1.0	6.0	
	1Y–2Y	1.0	7.0	
	2Y–6Y	1.5	8.0	
	6Y–12Y	2.0	8.0	
	>12Y	1.5	6.3	
Lymphocyte Count	D0–D3	3.0	8.0	x10^9/L
	D4–1M	2.0	8.0	
	1M–2M	3.0	16.0	
	2M–3M	4.0	10.0	
	3M-1Y	4.0	12.0	
	1Y–2Y	3.5	11.0	
	2Y–6Y	2.0	9.0	
	6Y–12Y	1.0	5.0	
	>12Y	1.0	4.0	
Monocyte Count	D0–D3	0.5	2.0	10^9/L
	D4–1M	0.5	1.0	
	1M–2M	0.3	1.0	
	2M–3M	0.4	1.2	
	3M-1Y	0.2	1.2	
	1Y–2Y	0.2	1.0	
	2Y–6Y	0.2	1.0	

	6Y–12Y	0.2	1.0	
	>12Y	0.2	1.0	

Test	Age Range	Reference Range		Reporting Units
		Lower Limit	Upper Limit	
Eosinophil Count	D0–D3	0.1	1.0	x10^9/L
	D4–1M	0.1	2.0	
	1M–2M	0.2	1.0	
	2M–3M	0.1	1.0	
	3M-1Y	0.1	1.0	
	1Y–2Y	0.1	1.0	
	2Y–6Y	0.1	1.0	
	6Y–12Y	0.1	1.0	
	>12Y	0.0	0.4	
Basophil Count	>12Y (Male/Female)	0.00	0.10	x10^9/L
Immature Granulocytes Count	>12Y (Male/Female)	0.00	0.00	x10^9/L
Metamyelocytes Count	>12Y (Male/Female)	0.00	0.00	x10^9/L
Myelocytes Count	>12Y (Male/Female)	0.00	0.00	x10^9/L
Promyelocytes Count	>12Y (Male/Female)	0.00	0.00	x10^9/L

Blasts Count	>12Y (Male/Female)	0.00	0.00	x10^9/L
Nucleated RBC's	>12Y (Male/Female)	0.00	0.01	x10^9/L

Test	Age Range	Reference Range		Reporting Units
		Lower Limit	Upper Limit	
Reticulocytes Count	D0–D3	120.00	400.00	x10^9/L
	D4–1M	50.00	350.00	
	1M–2M	20.00	60.00	
	2M–3M	30.00	50.00	
	3M-1Y	40.00	100.00	
	1Y–2Y	30.00	100.00	
	2Y–6Y	30.00	100.00	
	6Y–12Y	30.00	100.00	
	>12Y	50	150	
ESR	>12Y (Male)	1	10	mm/hr
	>12Y (Female)	1	15	

7. Reference Ranges for Routine and Special Haemostasis tests performed at Kings College Hospitals.

Adults Ranges (>12 years of age) for Routine Haemostasis Tests determined locally in March 2020 and reviewed with KCH Haematology clinical lead (Prof R Arya).

Normal limits provided for all other age range taken from published limits by Andrew M, Paes B, Milner R *et al*. Development of the coagulation system in the healthy premature infant. *Blood* 1988; 72: 1651–1657 and Maureen Andrew, B. Paes, and M Johnston. Development of the Haemostatic System in the neonate and young infant. ***The American journal of Paediatric Haematology / Oncology* 12 (1): 95 – 104, 1990**.

Test	Age Range (Male/Female)	Reference Range		Reporting Units
		Lower Limit	Upper Limit	
Prothrombin Time	D1 – D91	8.2	14.1	Seconds
	D91 – 12Y	9.6	11.8	
	>12Y	10.0	12.0	
INR Ratio	>12Y	0.90	1.15	Ratio
APTT (seconds)	D1 – D4	29.0	51.5	Seconds
	D5 – D21	28.0	55.0	
	D22 – D84	28.0	50.0	
	D85 – D175	28.0	45.0	
	D176 – Y01	28.0	40.0	
	01Y – 12Y	26.0	38.0	
	>12Y	20.0	29.0	
APTT Ratio	>12Y	0.80	1.14	Ratio
Thrombin Time	D1 – 12Y	9.2	15.0	Seconds
	>12Y	14.0	18.0	
Fibrinogen	D0 – 12Y	1.7	4.0	g/L
	>12Y	1.8	4.9	
D-Dimer	D1 – D12Y	≤312		ng/mL FEU

	>12Y	≤550	

Therapeutic Ranges for Anticoagulant Therapy Monitoring.

Test	Therapeutic Range		Units
	Lower Limit	Upper Limit	
INR Ratio (Vitamin K Anticoagulants)	2.0	4.0	Ratio
APTT Ratio (Unfractionated Heparin)	2.0	2.5	Ratio
Anti-X Level (LMWH)	0.1	1.0	IU/mL
Anti-Xa Level (UFH)	0.3	0.7	IU/mL

HIT Screen and ADAMTS-13 (Ranges from St' Thomas' Haemostasis)

Test	Reference Range		Units
	Lower Limit	Upper Limit	
HIT Screen	0.00	1.00	U/mL
ADAMTS-13 Activity	78.0	107.0	%
ADAMTS-13 Inhibitor	0.0	15.0	U/mL

	Negative <10.0 u/mL **Borderline 10.0 – 15.0 u/mL** **Positive >15.0 u/mL**	

Expected Peak and Trough level for Rivaroxaban, Apixaban, Edoxaban and **Dabigatran.**

Rivaroxaban		
Indication	Stroke prevention in NVAF	Treatment PE/VTE
Dose	20 mg once a day	20 mg once a day
Peak concentration (ng/mL)	249b (184–343)	270b (189–419)
Trough concentration (ng/mL)	44b (12–137)	26b (6–87)

Apixaban		
Indication	Stroke prevention in NVAF	Treatment PE/VTE
Dose	5 mg twice a day	5 mg twice a day
Peak concentration (ng/mL)	171c (91–321)	132c (59–302)
Trough concentration (ng/mL)	103c (41–230)	63c (22–177)

Edoxaban		
Indication	Stroke prevention in NVAF	Treatment PE/VTE
Dose	60 mg once a day	60 mg once a day

Peak concentration (ng/mL)	170d (125–245)	234e (149–317)
Trough concentration (ng/mL)	36e (19–62)	19e (10–39)

Dabigatran		
Indication	Stroke prevention in NVAF	Treatment PE/VTE
Dose	150 mg twice a day	150 mg twice a day
Peak concentration (ng/mL)	175a (117–275)	175a (117–275)
Trough concentration (ng/mL)	91a (61–143)	60a (39–95)

Thrombophilia Screen, Factors and vWF Screen Assays.

Test	**Age Range (Male/Female)**	**Reference Range**		**Units**
		Lower Limit	Upper Limit	
Factor II	>12Y (Male/Female)	50	150	IU/dL
Factor V		50	150	IU/dL
Factor VII		50	150	IU/dL
Factor X		50	150	IU/dL
Factor VIII		50	150	IU/dL
Chromogenic Factor VIII		50	150	IU/dL
Factor IX		50	150	IU/dL

Factor XI		60	150	IU/dL
Factor XII		40	150	IU/dL
APCR		0.95	1.23	Ratio
Free Protein S Antigen		60	150	%
Protein C Activity		70	140	U/dL
Antithrombin Activity		80	130	%
Antithrombin Antigen		71.70	118.5	U/dL
vWF Antigen		50	150	IU/dL
vWF: GPIbR Activity		34.1	118.6	IU/dL
vWF Collagen binding		35.4	136.9	U/dL
Plasminogen Activity		75.00	150.00	IU/dL

Lupus Anticoagulant Screen.

Test	**Age Range (Male/Female)**	**Reference Range**		**Units**
		Lower Limit	Upper Limit	
DRVVT Screen Ratio	>12Y (Male/Female)	0.82	1.11	Ratio
DRVVT Screen 50:50 Ratio		0.90	1.06	Ratio
DRVVT Confirm Ratio		0.89	1.08	Ratio
DRVVT Confirm 50:50 Ratio		0.93	1.06	Ratio

DRVVT Screen/Confirm Ratio		0.88	1.08	Ratio
DRVVT % correction of Ratio		≤10		%
DRVVT % Correction of 50:50 ratio		≤10		%
TSVT Ratio		0.91	1.09	Ratio
Ecarin Time Ratio		0.87	1.14	Ratio

Nutristasis Tests (Ranges from St Thomas' Haemostasis).

Test	Reference Range		Units
	Lower Limit	Upper Limit	
Vitamin K1	0.15	1.55	Ug/L
PIVKA-II	17.36	50.90	mAU/mL