1.0 INTRODUCTION

Hematology Laboratory is divided into 3 sub-units:

No	Laboratory	Operating Hours	Extension
i	Clinical	24-hours	5146
ii	Specialized	8am-5pm	5157
iii	Cytogenetic	8am-5pm	5652

2.0 TEST

2.1 Clinical Laboratory

No	Test	Tube	Request Form	TAT
i	Erythrocyte Sediment Rate (ESR)	1 ESR Tube	Per-PAT 301	2 hours
ii	Factor Assays (Factor VIII & Factor XI)	2 Citrated Tube	Per-PAT 301	2 days
iii	Full/Complete Blood Count (FBC)	1 EDTA Tube	Per-PAT 301	Urgent 1hour Non urgent 2hours
iv	Full Blood Picture	1 EDTA Tube	Per-PAT 301	Urgent: 3 days Semi urgent: 7 days Non urgent : 1 month
v	G6PD Screening	Filter Paper	Request Slip	24 hours
vi	Lupus Anticoagulant	2 Citrated Tube	Per-PAT 301	1 month
vii	Mixing, Inhibitor screening & Bethesda Assay	4 Citrated Tube	Per-PAT 301	3 days
vii	PT,APTT, Fibrinogen, D-Dimer	1 Citrated Tube	Per-PAT 301	Urgent: 1 hour Non urgent: 2hours
viii	Von Willebrand Antigen & Activity (Ricof)	2 Citrated Tube	Per-PAT 301	1 month
x	Outsourced test (PDN) i. Other Factor assays ii. Thrombophilia screening: Anti-Cardiolipin, β2GPI, AntiThrombin iii. ProteinC, Protein S, Factor V Leiden.	1 Citrated Tube for each test send	PDN request Form	6-8 weeks

2.2 Specialized Laboratory

No	Test	Tube	Request Form	Notes	TAT
i	Bone Marrow Aspirate	-	Per-PAT 301 (A4 Size)	By appoinment	3 days
ii	CD4/CD8	1 EDTA Tube	Per-PAT 301	Test Performed in batch. (Sample received Monday-Thursday only)	5 days
iii	CSF for Blast Cells	Universal container	Per-PAT 301	Sample should arrived in lab latest by 3pm	3 days
iv	Ham's test	1 EDTA Tube	Per-PAT 301	By appoinment	1 week
v	Hb Analysis	1 EDTA Tube	Per-PAT 301	Test Performed in batch	1 month
vi	Immunophenotyping	1 EDTA Tube	Per-PAT 301 (A4 Size)	By appoinment	3 days
vii	Kleihauer test	1 EDTA Tube	Per-PAT 301	By appoinment	3 days
viii	LAP Score	Blood taken in lab	Per-PAT 301	By appointment.	3 days
ix	OFT	Heparin tube	Per-PAT 301	By appoinment	3 days
x	PD fluid for WBC differential	Universal container	Per-PAT 301	By appoinment	3 days
xi	Serum Cryoglobulin Test	Blood taken in lab	Per-PAT 301	By appointment	3 days
xii	Urine eosinophils & hemosiderin	Universal container	Per- PAT 301		3 days
OUTSOURCED TEST					
i	DNA Analysis (Alpha thalassemia)	1 EDTA Tube	Per- PAT 301	Send to HKL	1-3 months
ii	DNA Analysis (Beta thalassemia)	1 EDTA Tube	Per- PAT 301	Send to IMR	14 days
iii	DNA Extraction	1 EDTA Tube	Per- PAT 301	Send to HKL	1-3 months
iv	Chromosome Study	Heparin tube	Special form	Send to HKL	3-6 months
v	Molecular diagnostic	1 EDTA Tube	Special form	Send to IMR	1-3 weeks
vi	Molecular test (PCR) : BCR ABL, JAK 2	1 EDTA Tube	Special form	Send to Hosp Ampang	2-8 weeks
vii	Bone marrow cytogenetic (follow up for cases done in IMR)	Cytogenetic Transport Media	Special form	Send to IMR	1-3 months
viii	Translocation leukemia	1 EDTA Tube	Special form	Send to IMR	1-3 months

2.3 Cytogenetic laboratory

No	Test	Tube	Request Form	TAT
i	Bone Marrow Cytogenetic	Cytogenetic Transport Media	Bone marrow cytogenetic request form	Urgent 14 days Non urgent 28 days

- Please complete the required Patient Information, Clinical Diagnosis, Disease status, Specimen information and Referring Physician in the request form. Incomplete request form may result in rejection of test.
- Samples are received every day preferably sent in the morning. Try to avoid sending sample on day follows by long public holidays.

COLLECTION TUBE AND TEST AT A GLANCE

	EDTA TUBE - FBC - PBF - CD4/CD8 - Ham's test - Kleihauer test - Hb Analysis -Immunophenotyping - DNA Analysis - DNA Extraction -Molecular Diagnostic - Molecular test		CITRATED TUBE - PT/APTT - D-dimer - Fibrinogen - LA - Thrombophilia screening - Factor Assay - Mixing - Inhibitor - Bethesday assay - Von Willerbrand test
	HEPARIN TUBE - OFT - Chromosome study		Universal Bottle - CSF for Blast Cells - PD fluid for WBC differential - Urine Eosinophils & Hemosiderin
	Cytogenetic Transport Media - Bone marrow cytogentic		ESR Tube - ESR

3.0 Test Requirement

3.1 Coagulation Test

3.1.1 Summary of recommendations for blood collection & handling for coagulation test:

i. Perform clean venepuncture with minimal stasis
ii. Use a 21-gauge needle or butterfly (19 gauge may be used in adults with good veins; 23 gauge may be required for infants)
iii. Do not use heparin-contaminated venous lines. Where this is unavoidable because of poor venous access, flush the line with crystalloid and discard the first few millilitres of blood (the first 5 ml)
iv. Use 0.105–0.109 M tri-sodium citrate (9 volumes blood to 1 volume anticoagulant)
v. Use plastic or siliconized glass collection tubes
vi. Ensure correct filling of tube
vii. Blood and anticoagulant should be mixed immediately by gentle inversion 5–6 times. Do not shake or vigorously mix the sample as this could cause haemolysis and activation of the clotting factors.
viii. If the haematocrit is >0.55, will need to adjust volume of anticoagulant
ix. Transport blood samples rapidly (ideally within 1 h) at room temperature.

Guidelines on the laboratory aspects of assays used in haemostasis and thrombosis, 2012 Blackwell Publishing Ltd, Int. Jnl. Lab. Hem

3.1.2 Summary of Differential Effects of Testing Different Sample Types on Hemostasis test:

Table 2_Summary of Differential Effects of Testing Different Sample Types on Select Hemostasis Tests

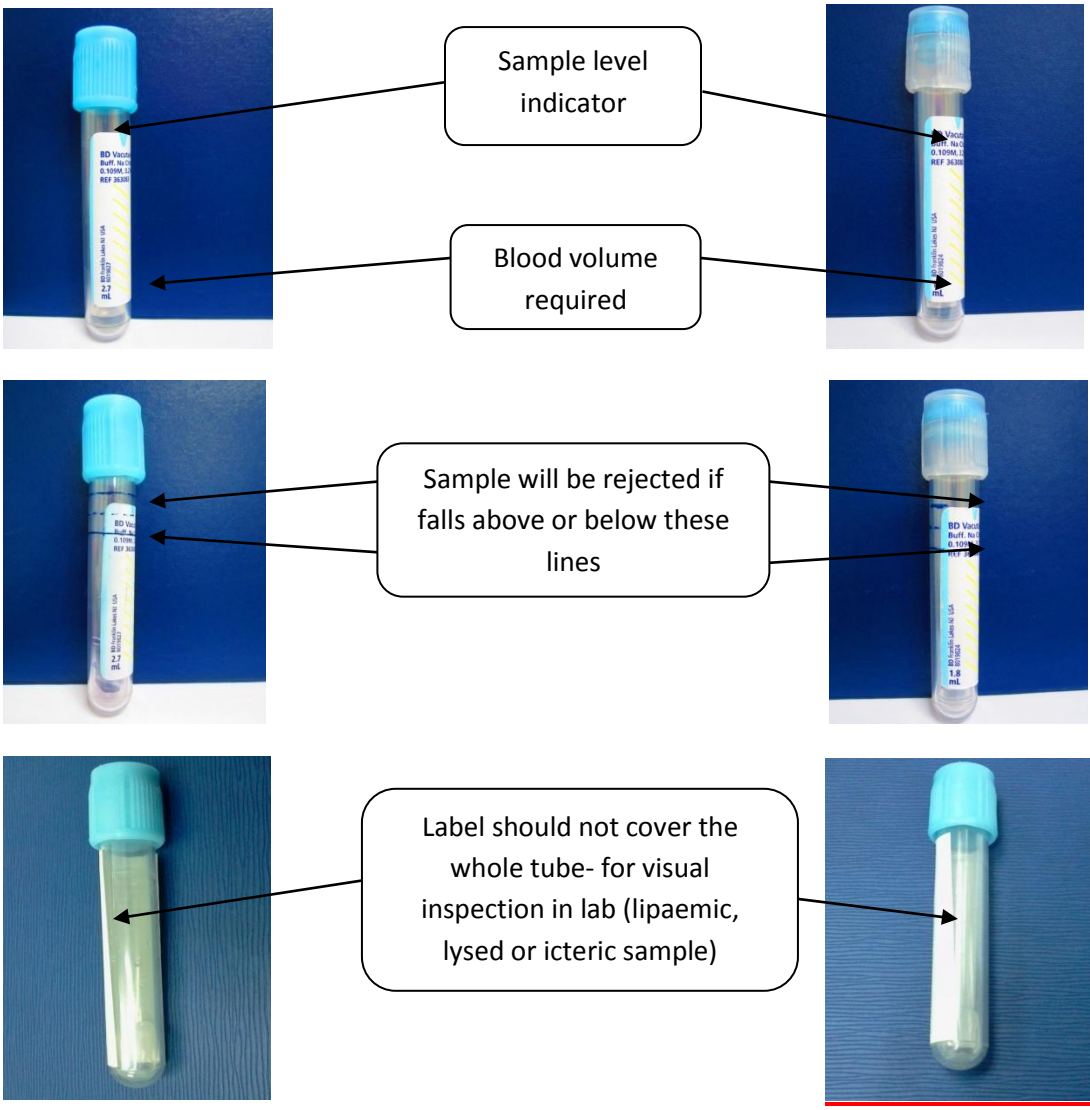
Sample Type	Routine Coagulation Tests	Potential Consequences On Factor Assays	Potential Consequences On Other Hemostasis Tests
EDTA plasma	Prolongs PT and APTT, and occasionally TT. Might influence fibrinogen and D-dimer assays	False low levels (especially FV and FVIII)	False impression of inhibitors to FV and FVIII, and may show time dependence (ie, enhanced with incubation); false LA feasible
Serum or fully clotted coagulation sample	No fibrinogen, so no clot in PT, APTT, or TT. False impression of afibrinogenemia. D-dimer assays can be affected especially if testing delayed	False low levels (especially FII, FV, and FVIII); false high FVII	False impression of factor inhibitors or VWD; false LA feasible
Partially clotted coagulation sample	Depending on relative extent of platelet activation, hemolysis and loss of fibrinogen might lead to false prolongation of PT, APTT, and TT, or false shortening of APTT	False low factor levels or false high factor VII	Flow obstructions in PFA-100 testing
Underfilled primary citrate anticoagulant tube	Will typically prolong PT, APTT, and TT. May underestimate fibrinogen and D-dimer	False low factor levels likely	False low levels of most hemostasis tests likely
Vitamin K-deficient plasma, patient on vitamin K antagonist therapy, liver disease sample	Prolongs PT and APTT (PT raised >APTT raised)	False low factors (especially FII, FVII, FIX, FX)	False low protein C (potentially different effect with clot-based assays vs chromogenic assays); false low protein S; false APCR; false LA feasible
Heparin 'contamination' (either ex-vivo or due to collection tube error)	Prolongs PT, APTT, and TT (usually TT raised >APTT raised >PT raised), false low fibrinogen	Reduced factors (especially FVIII, FIX, FXI, FXII)	False low Antithrombin; false LA feasible False impression of factor inhibitors

Table has been adapted and updated from reference 4.

®Pre-analytical Variables in Coagulation Testing Associated With Diagnostic Errors in Hemostasis- February 2012 ■ Volume 43 Number 2 ■ LABMEDICINE

COAGULATION REQUIREMENT AT A GLANCE

ADULT TUBE **PAEDIATRIC TUBE**



Requirement for coagulation tests request:

1. Sample volume adequate and well-mixed (gentle inversion five times). Documentation of time sample taken.
2. Detailed clinical history especially any bleeding/ family history should be sought from the patient and indicated in the request form as further test/analysis might need to be carried out. Please indicate if patient is on any anticoagulant.
3. Documentation of haematocrit level (only if hct>55%) – In this case, the blood:citrate ratio should be adjusted. Please call the lab (ext 5146) for a new tube with adjusted citrate volume.

Samples that does not fulfilled the above criteria will be rejected

3.2 Bone marrow aspirate (BMA)

- By appointment only. Request form should be countersigned by the clinical specialists in charge of the patient.
- Bone marrow aspirate is usually obtained from posterior iliac crest. It may be also obtained from a number of different sites such as sternum and tibia in children.
- Usually only the first 0.5 ml will contain marrow particle, therefore take no more than 0.5 ml into the first syringe for smears. Use a second syringe to aspirate if more samples are required for immunophenotyping (IP) and cytogenetic study. However, it is advisable to take an extra sample for IP in **all cases,** in case the reporting pathologist decides to run the IP.
- Immunophenotyping is also carried out in new cases of leukemia and lymphoma with marrow involvement.

3.3 Full Blood Picture

- Diagnosis and relevant clinical history including drugs or transfusion history should be provided in the request form.
- Request forms with no clinical history will be rejected.
- In anemia cases suggestive of iron deficiency, please do iron study first and treat accordingly before sending sample for FBP.

3.4 Hb analysis (HPLC and Hb electrophoresis).

- Thalasaemia screening is indicated in cases with first degree relatives of thalasaemia/haemoglobinopathy and cases with low or normal Hb with low MCH.
- For those with low Hb and low MCH, please provide iron study results when requesting for Hb analysis.
- In case of iron deficiency, please treat accordingly and repeat FBC after 1 month of treatment. Hb analysis is indicated if MCH is persistently low despite adequate iron.
- For family screening, please include the index case particulars (name/I.C./diagnosis) in the request form. In cases which need DNA analysis for confirmation, please send new sample to the laboratory along with Hb analysis report and latest FBC/FBP. (alpha thalassemia will be sent to HKL and Beta thalassemia will be sent to IMR)
- Please fill the request form properly as those with no relevant history will be rejected.

3.5 .CD4/CD8 count

- Specimen collection is on Mondays to Thursdays according to HIV Clinic days.
- If sample is taken on a day before public holiday, blood sample must reach the lab before 1 pm as ideally it should be analysed within 48 hours of collection.

END