The Clinical Haematology Referral Laboratory/MRKH (Department of Haematology, Hospital Ampang) is the national referral laboratory in the Ministry of Health for specialised haematology testing. Established in 2006, the outreach and impact of this laboratory have been significant. Given the complexity of these tests, this Handbook of Services has been compiled to help medical practitioners across the country not only to be aware of the indications and requirements for testing but also make appropriate choices. This contributes to optimal use of resources, efficiency and importantly, better patient care.

Dato' Dr Aishah Ahmad Makinuddin
Director
Hospital Ampang
PREFACE

Laboratory tests play a very crucial role in the diagnosis and management of patient care. These test results must therefore be precise, accurate and reliable and have to be made available to the clinicians in a timely manner. The generation of high quality results involves a step wise process of meticulous planning, perfect execution and thorough checking of results by the whole team involved.

This first edition of ‘HANDBOOK OF SERVICES IN CLINICAL HAEMATOLOGY - REFERRAL LABORATORY’ is intended to provide the essential core knowledge required before any routine or specialised haematology tests are ordered by hospital users, especially by those involved in haematology patient management.

The Clinical Haematology Referral Laboratory Hospital Ampang/MRKH is expected to play a lead role in haematology testing guidelines, especially in molecular and cytogenetic testing. We have provided a full purview of our laboratory general information, test indications, specimen handling, special handling requirements, urgent requests, storage & transportation and rejection criteria. It is also hoped that over a period of time a network of haematology laboratories can be established to centralise specific tests. This would save enormous time, money and resources.

I would also like to gratefully acknowledge the guidance and support of all experts of the Advisory Committee in preparing this ‘HANDBOOK OF SERVICES IN CLINICAL HAEMATOLOGY REFERRAL LABORATORY’.

Dato’ Dr Chang Kian Meng
Head and Consultant Haematologist
Department of Haematology
Hospital Ampang
HANDBOOK OF SERVICES IN CLINICAL HAEMATOLOGY REFERRAL LABORATORY

FIRST EDITION

HAEMATOLOGY DEPARTMENT HOSPITAL AMPANG

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Our appreciation also goes to:
Head of Pathology Department
All staffs of Clinical Haematology Referral Laboratory & Pathology Department Hospital Ampang who indirectly involved in publication of this handbook.
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</tbody>
</table>
1.0 DEPARTMENT OF HAEMATOLOGY OATH, VISION and MISSION STATEMENTS

1.1 Overview of the organization
The laboratory has adopted a quality management system for the effective and efficient use of its resources. All laboratory staffs are committed to the culture of quality. All staff share responsibility for identifying nonconformities and opportunities for improvement, documenting these instances so that corrective or preventive actions can be taken to ensure the laboratory meets the needs of its customers.

The Clinical Haematology Referral Laboratory consists of 7 units [Morphology, Haemostasis & Red cells, Flow cytometry, Molecular diagnostics (Haematology), Cytogenetics (Leukaemia), Bone marrow transplant and Haematopathology] providing specialized diagnostic services to various hospitals and clinics. Its function include providing comprehensive diagnostic services at a tertiary level and is the national referral laboratory, training laboratory personnel, medical officers, haematologists medical and allied health student.

1.2 Mission statement
i. To provide quality health care that is responsive to the needs of all including patients and staff.
ii. Comprises of a team of personnel who are competent, innovative and committed.
iii. To partner the individual and society in the promotion of health.
iv. To plan educational and professional development and performing biomedical research.

1.3 Vision statement
To be a national centre of excellence in the field of diagnostic haematology.

1.4 Objectives
The laboratory objectives are:
i. To provide an effective, efficient, comprehensive, reliable and dedicated diagnostic service.
ii. To produce accurate, reliable and timely analyses and results.
iii. To conduct research and development.
iv. To help training of staff specializing in haematology tests.
v. To achieve and maintain an effective quality management system
vi. To ensure the scope, standard and capability of the laboratory meets clinical needs and technology used state of the art, appropriate and cost-effective.
DEPARTMENT OF HAEMATOLOGY
ORGANISATION CHART

Director of Hospital Ampang

Head Department of Haematology

Daycare

Haematology Ward 7A

Haematology Ward 7B

Haematology Ward 8B

Transplant Ward 7D

Clinical Haematology Referral Laboratory

Clinic

Haemophilia / Thalassemia Daycare

Haematology Daycare Unit

Apheresis Unit

Haemato – Transplant Daycare Unit

Haematology Clinic

Haemophilia / Thalassemia Clinic
2.0 GENERAL OPERATING POLICIES

2.1 Introduction
The aim of this Handbook is to present the Clinical Haematology Referral laboratory in a clear and concise manner. There is a section devoted to each specialised unit with detailed information about available services and how to use them.

Our aim is to provide a wide range of high quality laboratory services for our users and patients, in a timely manner and consistent with best clinical practice. We welcome any comments or suggestions to improve our services. General comments should be addressed to Clinical Haematology Referral laboratory, Haematology Department, Hospital Ampang. For specific queries, please contact the appropriate Head of Unit.

2.2 Quality Assurance
All units aim to give the highest quality of service with the minimum of delay. To ensure this, all units participate in External Quality Assurance Programs. All work is subject to internal quality control checks. The individual units are enrolled in the Royal College of Pathologists of Australasia and/or UKNEQAS programs, and are currently transitioning to ISO 15189.

Clinical Haematology Referral laboratory, Haematology Department, Hospital Ampang is accredited by Royal College of Pathologists of Australasia (RCPA) for the training of pathologists (Haematology) [ RCPA ID:25792].

2.3 General Information

a) Location
The laboratory is located on Level 2 of the Hospital complex adjoining the Department of Pathology while Bone Marrow Transplant (BMT) Unit is located on level 7.

b) Address
Clinical Haematology Referral Laboratory, Level 2, Hospital Ampang, Jalan Pandan Mewah 68000 Ampang, Selangor Malaysia
c) Contact Numbers
Call direct line to respective laboratory unit: 03-4289xxxx followed by Extension number (Ext)

<table>
<thead>
<tr>
<th>UNIT</th>
<th>Extension number (Ext)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration</td>
<td>Ext 6219</td>
</tr>
<tr>
<td>Morphology</td>
<td>Ext 6532</td>
</tr>
<tr>
<td>Haemostasis</td>
<td>Ext 6461</td>
</tr>
<tr>
<td>Red Cell</td>
<td>Ext 6217</td>
</tr>
<tr>
<td>Flow Cytometry</td>
<td>Ext 6218</td>
</tr>
<tr>
<td>Haematopathology</td>
<td>Ext 6222</td>
</tr>
<tr>
<td>Molecular</td>
<td>Ext 6056</td>
</tr>
<tr>
<td>Cytogenetics</td>
<td>Ext 6055</td>
</tr>
<tr>
<td>Bone Marrow Transplant</td>
<td>Ext 6390</td>
</tr>
<tr>
<td>Medical Officer</td>
<td>Ext 6531/6530/6527</td>
</tr>
</tbody>
</table>

d) Operating Hours
7.30am - 5.30pm Monday to Friday (closed on national & Selangor public holidays, and weekends).

e) Customer Services
General comments, complaint or feedback should be addressed to:
Clinical Haematology Referral laboratory, Haematology Department, Hospital Ampang.
Or fax number: 03-42970059
For specific queries, please contact the appropriate Head of Unit.
3.0 GENERAL TEST ORDERING INFORMATION

3.1 Specimen/Request Forms
To ensure that requests are dealt with effectively, it is essential to comply with the following guidelines.

a) Specimens
Specimens should be placed in a securely fastened appropriate container.

Small (38x20mm) pre-printed labels may be attached to the specimen bottles. (Please do not use larger labels as these can obstruct automated equipment and delay result turnaround). Unlabelled samples will be rejected.

All specimens must be labelled with 2 identifier:
- Full patient name
- Identification Card (IC) number
and should have;
- Date and time of sampling
- Location/Ward

The container should be sealed and placed in the bag accompanied by a Special Haematology request form, or placed in a clear plastic bag, with the request form in the outside sleeve. Specimens should be transported to the laboratory as soon rapidly as possible to ensure sample integrity.

If a specimen is to be mailed, the packaging must comply with postal regulations.

Biohazard samples must be double bagged.

b) Request Forms
A completed HOSPITAL AMPANG SPECIAL LAB HAEMATOLOGY requisition form MUST accompany all specimens.

It is essential that the correct request form be completed to ensure an efficient flow of work. Please ensure that request forms and specimen labelling are completed as specified below and that the writing is legible.
A completed request form must accompany each specimen sent to the laboratory. It must clearly state the following legible information.

- Patient surname and forename
- Age and sex
- IC number or Hospital Ampang Registration number
- The requesting location and mailing address
- Relevant clinical history
- Tests being requested
- Type of specimen and date and time collected
- Indication if HIGH RISK status (see below)
- Name and mobile phone number of ordering physician. Molecular, flow cytometry and cytogenetic tests can be ordered only by a Specialist or Consultant.

Additional information may be required for some investigations, please see unit sections.

"Unknown" patients e.g. those admitted unconscious, unaccompanied or without documentation, should have their specimens identified with the A&E unique number.

Specimens will be discarded if labeling is inadequate, leaving the patient’s identification in doubt, if contents have leaked or been contaminated. In these circumstances every effort is made to inform the requesting doctor.

c) Clinical Details
When receiving a sample for analysis, it is important that sufficient and relevant, clinical information is provided to determine the type of test required. Certain samples require special techniques and may not be detected in the routine examination of a sample. Relevant details may include:

- Date of onset of illness
- Recent infections
- Underlying conditions eg diabetes, autoimmune disease, malignancy
- Pregnancy
- Foreign travel
- Transfusion & bleeding history

d) High Risk Specimens and Safety
High-risk groups include patients with clinical suspicion of:

- HIV infection
- Hepatitis B
- Hepatitis C
- Mycobacterium tuberculosis (TB)
- I.V. drug-use
- patients who have had recent foreign travel with unexplained high pyrexia
NB. Specimens and Request Forms MUST be labelled “High Risk”. The form must be folded to ensure confidentiality. The specimen must be sealed in the plastic transport bag. The specimen must then be placed in a secondary biohazard plastic bag and sealed.

To protect health care workers, requests for investigations on high risk patients should be minimise as far as possible.

3.2 Receipt of Specimens
All specimens should be delivered to Clinical Haematology Referral laboratory reception during working hours.

3.3 Urgent request
Please contact the relevant unit during working hours to alert staff to samples en route for urgent processing. Ordering physician should discuss with Lab Specialist before obtaining sample.

3.4 Urgent testing after office hours
It is essential to contact the Medical Officer on call before sending the specimen. This is only for URGENT FULL BLOOD PICTURE (FBP) and relevant URGENT haemostasis tests.

3.5 Specimen Handling
Haematology tests are extremely sensitive to methods of collection and preservation. It is important that sample collection and processing instructions be followed to ensure accurate test results.

3.5.1 Special Handling Requirements
Contact the relevant unit for information regarding special handling requirements.

3.5.2 Unacceptable samples
Samples which are incorrectly collected, labeled, processed, or transported will not produce accurate results. When a sample is found to be unacceptable, Laboratory will notify via telephone. If you have any question prior to collection or transportation of a sample, please contact the appropriate Laboratory unit.

3.6 Contact Form
For results dispatch and notification of unacceptable samples, provide name and fax number of Contact person. It will be the responsibility of the referring lab to notify us of any change in Contact person.
3.7 Turnaround Time
The turnaround time for each test is stated in the individual test description. For further details or to request expedited testing, please contact the respective laboratory unit.

3.8 Results/Reports

Printed reports
Printed reports to internal locations are dispatched via the internal mail system. Reports to external locations are sent via post.

Electronic reports
Results are available via the eHIS/LIS Hospital Information System for FBC, FBP, marrow, iron stores, cytospin, trephine, Haemostasis and Hb analysis.

3.9 Confidentiality
All tests and results are remains confidential.
GENERAL WORKFLOW OF CLINICAL HAEMATOLOGY REFERRAL LABORATORY

1. Receive specimen and Special Haematology Requisition form from clinics/wards or other hospital
2. Checking & sorting of samples
3. Register samples
4. Request accepted
   - YES: Distribute specimen to respective units:
     - Morphology
     - Flowcytometry
     - Haemostasis & Red Cells
     - Haematopathology
     - Cytogenetics
     - Molecular
     - BMT
   - NO: Reject Specimen
5. Process & analyze specimen
6. Results reporting
7. Send results
8. Discard specimen
9. End
LIST OF TESTS
PROVIDED BY
SPECIALISED HAEMATOLOGY UNIT
1. MORPHOLOGY UNIT

Introduction
The morphology unit provides Full Blood Count (FBC), Full Blood Picture (FBP), Bone Marrow Aspiration (BMA), cytospin for body fluids morphology and as well as iron stain.

List of services
1. Urgent services
   a. For Urgent Full Blood Picture after office hours please contact Hematology lab medical officer on-call via Hospital operator.
      - Urgent FBP is indicated only to rule out:
        i. Acute Leukaemia/APML
        ii. Microangiopathic Hemolytic Anemia (MAHA)
        iii. Active Haemolysis

2. Routine services
   a. Full Blood Count (FBC)
   b. Full Blood Picture (FBP)
   c. Bone Marrow Aspiration (Smear)
   d. Staining such as Wright Eosin, May Grunwald Giemsa, Leishman
   e. Body Fluids Morphology

3. Special services
   a. Cytochemistry stains (Iron Stain) run in batches

Instructions for Submitting Samples
A completed HOSPITAL AMPANG SPECIAL LAB HAEMATOLOGY requisition form MUST accompany all specimens.

Please note that incomplete or illegible labeling of forms and/or specimens, or use of incorrect specimen tubes, may result in delay or rejection of specimens.

Sample Requirements
a) Sample for morphology tests:
   i. Full Blood Count (FBC): 2.0 ml of peripheral blood must be received within 12 hrs of collection. Invert several times to mix blood.
   ii. Full Blood Picture (FBP): 2.0 ml of peripheral blood must be received within 6 hrs of collection. Invert several times to mix blood.
   iii. Bone marrow aspiration: will be smeared by lab staff
   iv. Body fluids for cytospin: minimum 1 ml. CSF/Body Fluids should be processed as soon as possible, or within 4-6 hours after collection.
b) Sample Labeling
Specimens should be labeled using a waterproof pen with at least **2 Unique patient identifiers**.

I. Patient’s Full Name (Surname, First name)
II. Patient identification number (Patient’s Hospital Number /IC / Passport / Military/Police number). Please provide full identification number (e.g IC: 123456-78-9012)

c) The collection date and time, and the origin (source) of the specimen, when applicable. The information on the specimen label should match the information on the lab requisition form.

d) Clinical history, reason for referral, prior therapy and transplant history should be written on the form.

**Rejection criteria:**
Specimen and test requests will be rejected if:
1. Incomplete information on the test request form (clinical history is not provided, incomplete IC no, specimen site is not stated, name of requesting doctor is not stated)
2. Unlabelled specimen
3. Clotted samples
4. Delayed samples
5. Wrong container

**Performing Laboratory**
Morphology Unit, Clinical Haematology Referral Laboratory, Department of Haematology, Hospital Ampang. Contact number: 03-42896532

**Setup Schedule**
Setup: Monday-Friday 8.00am to 5.00pm
After office hours, Weekends, Public Holidays: Urgent FBP requests only
Table 1.1 List of tests offered at Morphology Unit

<table>
<thead>
<tr>
<th>No</th>
<th>Test name</th>
<th>Method</th>
<th>Specimen type</th>
<th>Container type</th>
<th>Volume required</th>
<th>Department instructions</th>
<th>TAT</th>
<th>Unit*Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Full Blood Count (FBC)</td>
<td>Flowcytometry/RF DC Method</td>
<td>Whole Blood</td>
<td>K2/K3 EDTA Tube</td>
<td>2 ml</td>
<td>Sample must be received within 12 hrs of collection. Lipaemic/icteric samples can affect performance of test and may delay results</td>
<td>Urgent : 45 min</td>
<td>Non urgent : 8 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Urgent : 45 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Urgent : 45 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Urgent : 45 min</td>
</tr>
<tr>
<td>2</td>
<td>Full Blood Picture (FBP)</td>
<td>Wright Eosin Staining</td>
<td>Whole Blood</td>
<td>K2/K3 EDTA Tube</td>
<td>2 ml</td>
<td>Sample must be received within 6 hrs of collection</td>
<td>Urgent : 1 hour after reception</td>
<td>Test offer outside Hospital Ampang (Klinik Kesihatan)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For Urgent Full Blood Picture after office hours please contact</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Haematology lab medical officer on call</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Please take note : Urgent FBP is only indicated for cases to rule out :</td>
</tr>
<tr>
<td>Test Name</td>
<td>Methodology</td>
<td>Sample Source</td>
<td>Volume</td>
<td>Transport Method</td>
<td>Turnaround Time</td>
<td>Notes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>---------------</td>
<td>--------</td>
<td>------------------</td>
<td>----------------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Body Fluids Morphology</td>
<td>Cytospin</td>
<td>Body Fluids</td>
<td>1 ml</td>
<td>Transport to lab immediate after collection</td>
<td>24 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Bone marrow Aspirate for May Grunwald Giemsa Stain</td>
<td>May Grunwald Giemsa Stain</td>
<td>Marrow Aspirate Smear</td>
<td>Minimum 6 slides</td>
<td>Air Dry Transport in slides Holder</td>
<td>7 Days</td>
<td>2nd opinion for slide review (from other hospitals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Iron Stain</td>
<td>Perl's Prussian Blue staining</td>
<td>Marrow Aspirate Smear</td>
<td>Minimum 2 slides</td>
<td>Air Dry Transport in</td>
<td>7 days</td>
<td>2nd opinion for slide review (from other hospitals)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Table 1.2 Reference range**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hemoglobin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males &lt;60</td>
<td>13.5-17.4</td>
<td>g/dl</td>
</tr>
<tr>
<td>Males &gt;60</td>
<td>11.8-16.9</td>
<td>g/dl</td>
</tr>
<tr>
<td>Females</td>
<td>11.6-15.1</td>
<td>g/dl</td>
</tr>
<tr>
<td><strong>RBC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males &lt;60</td>
<td>4.53-5.95</td>
<td>$10^{12}$/L</td>
</tr>
<tr>
<td>Males &gt;60</td>
<td>3.86-5.62</td>
<td>$10^{12}$/L</td>
</tr>
<tr>
<td>Females</td>
<td>3.87-5.21</td>
<td>$10^{12}$/L</td>
</tr>
<tr>
<td><strong>Hematocrit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males &lt;60</td>
<td>40.1-50.6</td>
<td>%</td>
</tr>
<tr>
<td>Males &gt;60</td>
<td>35.7-48.9</td>
<td>%</td>
</tr>
<tr>
<td>Females</td>
<td>35.1-44.9</td>
<td>%</td>
</tr>
<tr>
<td><strong>MCV</strong></td>
<td>80.6-95.5</td>
<td>fL</td>
</tr>
<tr>
<td><strong>MCH</strong></td>
<td>26.9-32.3</td>
<td>pg</td>
</tr>
<tr>
<td><strong>MCHC</strong></td>
<td>31.9-35.5</td>
<td>pg</td>
</tr>
<tr>
<td><strong>RDWSD</strong></td>
<td>37.5-48.1</td>
<td></td>
</tr>
<tr>
<td><strong>RDW-CV</strong></td>
<td>12-14.8</td>
<td>%</td>
</tr>
<tr>
<td><strong>Ret He</strong></td>
<td>30.7-38.9</td>
<td>pg</td>
</tr>
<tr>
<td><strong>Retic</strong></td>
<td>0.4-106</td>
<td>%</td>
</tr>
<tr>
<td><strong>RPI</strong></td>
<td>0.1-1.5</td>
<td>%</td>
</tr>
<tr>
<td><strong>IRF</strong></td>
<td>0-8.9</td>
<td>%</td>
</tr>
<tr>
<td><strong>Platelets</strong></td>
<td>142-350</td>
<td>$10^{10}$/L</td>
</tr>
<tr>
<td><strong>IPF</strong></td>
<td>0-4</td>
<td>%</td>
</tr>
<tr>
<td><strong>MPV</strong></td>
<td>8.9-11.9</td>
<td>fL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total WBC</strong></td>
<td>4078-11370</td>
<td>Cells/µl</td>
</tr>
<tr>
<td><strong>Neutrophils</strong></td>
<td>3929-7147</td>
<td>Cells/µl</td>
</tr>
<tr>
<td><strong>Lymphocytes</strong></td>
<td>1847-4807</td>
<td>Cells/µl</td>
</tr>
<tr>
<td><strong>Monocytes</strong></td>
<td>385-1141</td>
<td>Cells/µl</td>
</tr>
<tr>
<td><strong>Eosinophils</strong></td>
<td>0-827</td>
<td>Cells/µl</td>
</tr>
<tr>
<td><strong>Basophils</strong></td>
<td>0-95</td>
<td>Cells/µl</td>
</tr>
</tbody>
</table>

2. FLOW CYTOMETRY

Introduction
The Flow cytometry Laboratory provides services to support the investigation and monitoring for patients with various hematological malignancies. The aim of leukaemia and lymphoma immunophenotyping is to identify the lineage of the neoplastic cells and level of maturation to aid the classification of leukaemia and lymphoma. Flow cytometry immunophenotyping also aids in the minimal residual disease monitoring (MRD) and Paroxysmal Nocturnal Haemoglobinuria (PNH).

Test Indication
Acute Leukaemia, Lymphoma, Multiple Myeloma, PNH and MRD.

Instructions for Submitting Samples
A completed HOSPITAL AMPANG SPECIAL LAB HAEMATOLOGY requisition form MUST accompany all specimens.

Please note that incomplete or illegible labeling of forms and/or specimens, or use of incorrect specimen tubes, may result in delays or rejection of specimens.

Sample Requirements
a) Samples for Flow Cytometry Immunophenotyping
   - Bone Marrow Aspirates/ Peripheral Blood : Samples must be sent in K2 EDTA and must reach the laboratory within 24 hours of draw.
   - CSF/ Body Fluid: Samples must be sent in special medium which can be obtained from Cytogenetics Laboratory, Hospital Ampang. Samples must be sent immediately and reach the lab within 4 hours of sampling to ensure viability of the cells.

b) Sample Labeling
   Specimens should be labeled using a waterproof pen with at least 2 Unique patient identifiers.
   I. Patient’s Full Name (Surname, First name)
   II. Patient identification number (Patient’s Hospital Number /IC / Passport / Military/Police number). Please provide full identification number (e.g IC: 123456-78-9012).

c) The collection date and time, and the origin (source) of the specimen, when applicable. The information on the specimen label should match the information on the lab requisition form.

d) Clinical history, reason for referral, prior therapy and transplant history should be written on the form.
Collection Instructions
- BMA/Blood in K2 EDTA tube: Invert several times to mix blood or bone marrow.
- CSF/ Body Fluids should be processed as soon as possible and not more than four hours after collection.

Storage and Transportation
Samples should be transported in 4°C to avoid apoptosis. Use cold pack for transport. Ensure cold pack is not in direct contact with specimen during transport. The specimen must arrive at the lab no more than 24 hours after collection. (Except for CSF/Body Fluids).

Rejection Criteria
- Fixed or frozen specimens
- Clotted specimen
- Insufficient blood/bone marrow samples
- Specimens in anticoagulants other than K2 EDTA tube.

Performing Laboratory
Flow Cytometry Unit. Clinical Haematology Referral Laboratory, Department of Haematology, Hospital Ampang. Contact number: 03-4289 6218

Setup Schedule
Setup: Monday-Friday
Service time: 7.30am to 4.30pm
<table>
<thead>
<tr>
<th>No</th>
<th>Test name</th>
<th>Specimen Type</th>
<th>Container Type</th>
<th>Volume required</th>
<th>Department Instructions</th>
<th>TAT</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Immunophenotyping of Leukaemia/Lymphoma /Multiple Myeloma</td>
<td>Blood or Bone Marrow Aspirate</td>
<td>K2 EDTA tube</td>
<td>3 ml</td>
<td>Bone Marrow Aspirates/Peripheral Blood: Samples must be sent in K2 EDTA and must reach the laboratory within 24 hours of draw.</td>
<td>Urgent : 1 working day Routine : 7 working days</td>
<td>Only internal sample</td>
</tr>
<tr>
<td>2</td>
<td>Paroxysmal Nocturnal Haemoglobinuria (PNH)</td>
<td>Blood</td>
<td>K2 EDTA tube</td>
<td>3 ml</td>
<td>Internal PNH samples must be sent immediately to the lab within 4 hours of draw.</td>
<td>7 working days</td>
<td>Referral lab for PNH</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>External PNH samples are accepted within 7 days of draw.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Immunophenotyping of Leukaemia/Lymphoma /Multiple Myeloma</td>
<td>CSF/Body Fluids</td>
<td>Transport Medium</td>
<td>Min 1 ml</td>
<td>Samples must be sent in special medium which can be obtained from Cytogenetics Unit, Hospital Ampang. Samples must be sent immediately and reach the lab within 4 hours of sampling to ensure viability of the cells.</td>
<td>1 working day</td>
<td>Only internal sample</td>
</tr>
<tr>
<td></td>
<td>Immunophenotyping of Leukaemia/Lymphoma/Multiple Myeloma</td>
<td>Body fluids (other than CSF)</td>
<td>Transport Medium</td>
<td>1-2 ml</td>
<td>Samples must be sent in special medium which can be obtained from Cytogenetics Unit, Hospital Ampang. Samples must be sent immediately and reach the lab within 4 hours of sampling to ensure viability of the cells.</td>
<td>Urgent : 1 working day Routine : 7 working days</td>
<td>Only internal sample</td>
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</tr>
</tbody>
</table>


3. HAEMOSTASIS & RED CELLS UNIT

Introduction
The Haemostasis Laboratory provides a diagnostic service to evaluate bleeding and thrombotic disorders. The laboratory perform routine coagulation test (PT, INR, APTT, Fibrinogen, Thrombin Time, D-Dimer), Factor assays and von Willebrand Factor assays (vWF:Ag, vWF:Act, vWF:Ricof, CBA). The laboratory also does Thrombophilia test (Protein C, Protein S, Antithrombin), Lupus anticoagulant assay and Platelet function test for special situations.

The Red Cell Unit offers Hb Analysis (Capillary electrophoresis and Gel electrophoresis) and DNA analysis for Thalassemia (sent to referral lab- IMR and HKL). The unit also performs osmotic fragility test and serum erythropoietin.

Test indication
All tests must be consulted with Haematologist with submission of complete clinical history.

List of services
A) Haemostasis Unit

1. Urgent services
   a) Coagulation screen (examples: PT, INR, APTT, Fibrinogen, TT, D-Dimer) within 1 hour of request.
   b) Factor assays to diagnose haemophilia.

2. Routine services
   a) Coagulation screen (TAT-within 1 day)

3. Special services
   a. Test run in batches – Lupus anticoagulant screen, CBA, ADAMTS-13
   b. Test run by appointment – Factor assays, vWF assays, Platelet Aggregation test, Anti-Xa.

B) Red Cells Unit

1. Special services
   a. Test run in batches – Hb Analysis
   b. Test (refer to referral lab) – DNA analysis for Thalassemia.

Instructions for Submitting Samples
A completed HOSPITAL AMPANG SPECIAL LAB HAEMATOLOGY requisition form MUST accompany all specimens.

Please note that incomplete or illegible labeling of forms and/or specimens, or use of incorrect specimen tubes, may result in delays or rejection of specimens.
The sample for haemostasis test from outside of Hospital Ampang, please put in dried ice but no direct contact with the sample; otherwise it will be rejected.

**Sample Requirements**
a) Samples for Haemostasis & Red cells as per table 3.1 and 3.2

b) Sample Labeling
   Specimens should be labeled using a waterproof pen with at least **2 Unique patient identifiers**.
   I. Patient’s Full Name (Surname, First name)
   II. Patient identification number (Patient’s Hospital Number /IC / Passport / Military/Police number). Please provide full identification number (e.g IC: 123456-78-9012).

c) The collection date and time, and the origin (source) of the specimen, when applicable. The information on the specimen label should match the information on the lab requisition form.

d) Clinical history, reason for referral, prior therapy and transplant history should be written on the form.

**Sample for Hb Analysis (Hb Electrophoresis):**

- Thalassemia screening is indicated in cases with first degree relatives of thalassemia/hemoglobinopathy and cases with low or normal Hb with low MCH <25 pg.
- In case of iron deficiency, please treat accordingly and repeat FBC after 3 month of treatment. Hb analysis is indicated if MCH is persistently low < 25pg despite adequate iron therapy.
- For family screening, please include the index case particulars (name/IC/diagnosis) in the request form.
- In cases which need DNA analysis for confirmation, please send a new sample together with the PER PAT 301 form to the laboratory along with Hb analysis report and latest FBC/FBP. (Alpha DNA analysis will be sent to HKL and Beta DNA analysis will be sent to IMR).
- Please fill the request form properly as those with no relevant history will be rejected.
### Table 3.1 List of tests offered at Haemostasis Unit

<table>
<thead>
<tr>
<th>Test Name</th>
<th>Specimen Type</th>
<th>Container Type</th>
<th>Volume Required</th>
<th>Department Instructions</th>
<th>TAT</th>
<th>Remarks</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulation test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PT (Prothrombin Time)</td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2% x1</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>Routine: 1 day</td>
<td>Routine</td>
<td>Stago: 11.4-13.5 Sec ACL : 11.5-14.9 Sec</td>
</tr>
<tr>
<td>APTT (activated partial tromboplastin time)</td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>Routine: 1 day</td>
<td>Routine</td>
<td>Stago: 34.3-47.2 Sec ACL : 27.1-38.7 Sec</td>
</tr>
<tr>
<td>Fibrinogen</td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>Routine: 1 day</td>
<td>Routine</td>
<td>2.00-4.00 g/L</td>
</tr>
<tr>
<td></td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>Routine: 1 day</td>
<td>Urgent request: within 1 hour</td>
<td>Routine</td>
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<tr>
<td>D-Dimer</td>
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</tr>
<tr>
<td>Thrombin Time</td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>Routine: 1 day</td>
<td>Urgent request: within 1 hour</td>
<td>Routine</td>
</tr>
<tr>
<td>Factor Assay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor II Assay</td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Known case - 1 tube (until indicated mark)</td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>1 day for urgent request</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor V Assay</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Factor VII Assay</td>
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<tr>
<td>Factor VIII Assay</td>
<td></td>
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<tr>
<td>Factor IX Assay</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor X Assay</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor XI Assay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor XII Assay</td>
<td></td>
<td></td>
<td>Out source - (New case) Collect until indicated mark x 3 tubes</td>
<td>OR Separate plasma from cells as soon as possible</td>
<td>5 working days for normal request</td>
<td>By appointment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor XIII</td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td><strong>Known case</strong> - 1 tube (until indicated mark)</td>
<td>Deliver tubes immediately to the laboratory at room temperature OR Separate plasma from cells as soon as possible Store frozen at -40°C and transport frozen plasma on dried ice</td>
<td>1 day for urgent request 5 working days for normal request</td>
<td>By appointment</td>
<td>50-150%</td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
</tr>
<tr>
<td><strong>Von Willebrand Factor Assay</strong></td>
<td><strong>Blood (Plasma)</strong></td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 3 tubes</td>
<td>Deliver tubes immediately to the laboratory at room temperature OR Separate plasma from cells as soon as possible</td>
<td>1 day for urgent request 5 working days for normal request</td>
<td>By appointment</td>
<td>52.9-182.5% 63.5-140.7% 59.8-131.5%</td>
</tr>
<tr>
<td>VWF Antigen</td>
<td><strong>VWF Activity</strong></td>
<td><strong>VWF : Ricof</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LUPUS ANTICOAGULANT ASSAY</td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 4-6 tubes</td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>2 weeks</td>
<td>Batches</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
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<td>--------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>DRVV Screen</td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 4-6 tubes</td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>2 weeks</td>
<td>Batches</td>
<td></td>
</tr>
<tr>
<td>DRVV Confirm</td>
<td></td>
<td></td>
<td></td>
<td>OR Separate plasma from cells as soon as possible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTT LA</td>
<td></td>
<td></td>
<td></td>
<td>Store frozen at -40°C and transport frozen plasma on dried ice</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CBA (Collagen Binding Assay)-ELISA</th>
<th>Blood (Plasma)</th>
<th>Trisodium Citrate 3.2%</th>
<th>Collect until indicated mark x 1 tube</th>
<th>Deliver tubes immediately to the laboratory at room temperature</th>
<th>4-6 weeks</th>
<th>Batches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OR Separate plasma from cells as soon as possible</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Store frozen at -40°C and transport frozen plasma on dried ice</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

Group O: 62-138%
Non-Group O: 86-160%
Store frozen at -40°C and transport frozen plasma on dried ice

Platelet count must be <10x10^9/L in plasma prior to freezing

<table>
<thead>
<tr>
<th>Thrombophilia Test</th>
<th>Antithrombin Activity</th>
<th>Protein C Activity</th>
<th>Protein S Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 1 tube</td>
</tr>
<tr>
<td></td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>OR Separate plasma from cells as soon as possible</td>
<td>Store frozen at -40°C and transport frozen plasma on dried ice</td>
</tr>
<tr>
<td></td>
<td>2 weeks</td>
<td>Batches</td>
<td>70 - 142%</td>
</tr>
<tr>
<td></td>
<td>55 – 140%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free Protein S</td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 1 tube</td>
</tr>
<tr>
<td></td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>1 day (same day)</td>
<td>By appointment</td>
</tr>
<tr>
<td></td>
<td>50 – 150%</td>
<td></td>
<td>Therapeutic Range: 0.7 – 1.2 IU/ml (after 4 hrs)</td>
</tr>
<tr>
<td>Anti Xa</td>
<td>Blood (Plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 1 tube</td>
</tr>
<tr>
<td></td>
<td>Deliver tubes immediately to the laboratory at room temperature</td>
<td>1 day (same day)</td>
<td>By appointment</td>
</tr>
<tr>
<td></td>
<td>70 - 142%</td>
<td></td>
<td>Therapeutic Range: 0.7 – 1.2 IU/ml (after 4 hrs)</td>
</tr>
</tbody>
</table>
**Platelet Aggregation Test**

<p>| Blood (Platelet Rich Plasma) | Trisodium Citrate 3.2% x 4-6 tubes and EDTA x 1 tube | Collect until indicated mark x 4-6 tubes | Deliver tubes immediately to the laboratory at room temperature (platelets are activated at cold temperature) Do not refrigerate or freeze specimen | 1 day (Same day) | By appointment (Case need to be discussed with Haematologist prior testing) | Total aggregation (% @ 5 min) : ADP : 63-89% Arachidonic Acid: 65-90% Collagen : 61-99% Epinephrine : 54-101% | infusion |</p>
<table>
<thead>
<tr>
<th>ADAM TS-13 ACTIVITY</th>
<th>Blood (plasma)</th>
<th>Trisodium Citrate 3.2%</th>
<th>Collect until indicated mark x 1 tube</th>
<th>Deliver tubes immediately to the laboratory at room temperature OR Separate plasma from cells as soon as possible. Store frozen at -40°C and transport frozen plasma on dried ice</th>
<th>4-6 weeks</th>
<th>Batches</th>
<th>ADAMTS-13 ACTIVITY : 40-130%</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADAM TS-13 INHIBITOR</td>
<td>Blood (plasma)</td>
<td>Trisodium Citrate 3.2%</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tubes immediately to the laboratory at room temperature OR Separate plasma from cells as soon as possible. Store frozen at -40°C and transport frozen plasma on dried ice</td>
<td>4-6 weeks</td>
<td>Batches</td>
<td>ADAMTS-13 INH : Negative : &lt;12 U/ml Boderline : 12-15 U/ml Positive : &gt;15 U/ml</td>
</tr>
<tr>
<td>Test Name</td>
<td>Specimen Type</td>
<td>Container Type</td>
<td>Volume Required</td>
<td>Department Instructions</td>
<td>TAT</td>
<td>Remarks</td>
<td>Normal Range</td>
</tr>
<tr>
<td>---------------------------</td>
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<td>----------------------------------------------------------------</td>
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<td>-----------------------------------</td>
</tr>
<tr>
<td>Hemoglobin Analysis</td>
<td>Whole blood</td>
<td>K2/K3 EDTA tube</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tubes within 24 hours to the laboratory at room temperature</td>
<td>1 month</td>
<td>Batches</td>
<td>Guideline for the range, need to refer the QC pattern from the gel staining</td>
</tr>
<tr>
<td>Gel Electrophoresis</td>
<td>Whole blood</td>
<td>K2/K3 EDTA tube</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tubes within 24 hours to the laboratory at room temperature</td>
<td>1 month</td>
<td>Batches</td>
<td>Hb A : 96.8-97.8% Hb A2 : 2.2-3.2%</td>
</tr>
<tr>
<td>Capillary Electrophoresis</td>
<td>Whole blood</td>
<td>K2/K3 EDTA tube</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tubes within 24 hours to the laboratory at room temperature</td>
<td>1 month</td>
<td>Batches</td>
<td></td>
</tr>
<tr>
<td>DNA analysis for Thalassaemia</td>
<td>Whole blood</td>
<td>K2/K3 EDTA tube</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tubes within 24 hours to the laboratory at room temperature</td>
<td>90 working days</td>
<td>Outsourced. (MUST use DNA IMR/CaRC/HA EM/22/2203/03(1)/REQForm and consent form)</td>
<td>Result based on molecular test : (Alpha from HKL, Beta from IMR)</td>
</tr>
<tr>
<td>Test</td>
<td>Type</td>
<td>Tube</td>
<td>Volume</td>
<td>Handling &amp; Storage</td>
<td>Stabilization Period</td>
<td>Turnaround Time</td>
<td>Interpretation</td>
</tr>
<tr>
<td>-------------------------------</td>
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</tr>
<tr>
<td>Serum EPO (Erythropoietin)</td>
<td>Whole blood</td>
<td>Plain tube</td>
<td>3.5 ml (in patient)</td>
<td>Deliver tubes immediately to the laboratory at room temperature. OR Separate serum from cells as soon as possible. Store frozen at -40°C and transport frozen serum on dried ice.</td>
<td>MDS: 6-8 weeks</td>
<td>Batches</td>
<td>Plain tube</td>
</tr>
<tr>
<td></td>
<td>Serum</td>
<td></td>
<td></td>
<td></td>
<td>MPN &amp; PRV: 12 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osmotic Fragility Test (OFT)</td>
<td>Whole blood</td>
<td>Heparin tube</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tube immediately to the laboratory at room temperature</td>
<td>1 day (same day)</td>
<td>By appointment</td>
<td>Result interpreted by the graph shifted to the right or left compared to standard.</td>
</tr>
<tr>
<td>Kleihauer Test</td>
<td>Whole blood</td>
<td>K2/K3 EDTA Tube</td>
<td>Collect until indicated mark x 1 tube</td>
<td>Deliver tube immediately to the laboratory at room temperature</td>
<td>1 week</td>
<td>By appointment</td>
<td>Fetal cells stained red. Adult ghost cells stained pale pink. Lymphocytes stained grey.</td>
</tr>
</tbody>
</table>
Note:
1. Thrombophilia test– Indicated for investigation of Purpura Fulminans (in newborn) and upon discussion with hematologist (for selected case ONLY).

2. Platelet Aggregation test: For control sample, patient needs to bring along a friend or relative with same gender & age to be tested.

3. Lupus Anticoagulant Assay- Result & Interpretation:

<table>
<thead>
<tr>
<th>DRVVT Screen Ratio</th>
<th>= dRVVT Screen (Time of patient Sec.) dRVVT Screen (Time of Normal control Sec.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRVVT Confirm Ratio</td>
<td>= dRVVT Confirm (Time of patient Sec.) dRVVT Confirm (Time of Normal control Sec.)</td>
</tr>
<tr>
<td>Normalize final ratio</td>
<td>= dRVVT screen ratio dRVVT confirm ratio</td>
</tr>
</tbody>
</table>

**Final result:**
- Ratio > than 2.0 = Strong Positive for Lupus Anticoagulant.
- Ratio 1.6-2.0= Moderate Positive for Lupus Anticoagulant.
- Ratio 1.2-1.5= Weak Positive for Lupus Anticoagulant.
Table 3.2 Summary of Differential Effects of Testing Different Sample Types on Hemostasis test:

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

a) Hb analysis

- Wrong sample container.
- Duplicate order.
- Sample delayed
- Test not indicated. Normal FBC result.
- Insufficient sample
- Poorly haemolysed sample

b) DNA analysis

- Wrong request form and no consent form attached.
- No Hb analysis result

c) Haemostasis Test

- Blood clotted
- Blood Hemolysed
- Wrong container
- Insufficient sample (under fill or over fill)
- Delayed sample received (PT and APTT- tested within 4 hours from time of specimen collection.)
- For outsourced; the sample will be rejected if is not in dried ice.

**Performing Laboratory**

a) Haemostasis Unit, Clinical Haematology Referral Laboratory, Department of Haematology, Hospital Ampang. Contact number: 03-42896461.

b) Red Cells Unit, Clinical Haematology Referral Laboratory, Department of Haematology, Hospital Ampang. Contact number: 03-42896217

**Setup Schedule**

Setup: Monday-Friday
Weekend: Depending on the cases (confirmation by Consultant Haematology)
Service time: 7.30am to 5.30pm
Service after office hours: 5.30pm to 7.30am

**Reference range**

Refer to table 3.1
4. HAEMATOPATHOLOGY UNIT

Introduction
The Haematopathology unit provides a wide range of diagnostic services to support the investigation and treatment monitoring for patients with various haematological malignancies. These include tissue processing, haematoxylin and eosin staining, immunohistochemistry tests and special staining.

Tests offered in Haematopathology unit include histopathologic examination of bone marrow trephine, soft tissue biopsies (haematology related) and second opinion on previous histopathology findings.

Test indication
Bone marrow trephine histology examination is indicated for diagnosis, disease staging and therapeutic monitoring of various lymphoproliferative disorders. Furthermore, it is also indicated for investigation of cytopenia, anaemia, thrombocytosis, and leukocytosis.

Instructions for Submitting Samples for histopathology examination
A completed HOSPITAL AMPANG SPECIAL LAB HAEMATOLOGY requisition form MUST accompany all specimens.

Please note that incomplete or illegible labeling of forms and/or specimens, or use of incorrect specimen tubes, may result in delays or rejection of specimens.

For biopsies done in Hospital Ampang, respective units/ departments are encouraged to obtain formalin from Haematopathology Lab – Level 2, before doing the procedure, so as to assist in maintaining quality in pre-analytical stage of processing of specimen.

Sample Requirements
a) Samples for Haematopathology:
   - bone marrow trephine
   - soft tissue biopsies (haematology related)

b) Sample Labeling
   Specimens should be labeled using a waterproof pen with at least 2 Unique patient identifiers.
   
   I. Patient’s Full Name (Surname, First name)
   II. Patient identification number (Patient's Hospital Number /IC / Passport / Military/Police number). Please provide full identification number (e.g IC: 123456-78-9012).

c) The collection date and time, and the specimen anatomical sites. The information on the specimen label should match the information on the lab requisition form.

d) Clinical history, reason for referral, prior therapy and transplant history should be written on the form.
Special Instruction
Please collect 10% buffered formalin from Haematopathology Laboratory prior to tissue biopsy procedure.

Storage and Transportation
Specimen should be fixed using 10% buffered formalin at room temperature.

Rejection criteria:
Specimen and test requests will be rejected if:
- Polylysine coated unstained slides are not provided.
- Incomplete information on the test request form (clinical history is not provided, incomplete IC no, specimen site is not stated, name of requesting doctor is not stated).
- Unlabelled specimen

Performing Laboratory
Haematopathology Unit, Clinical Haematology Referral Laboratory, Department of Haematology, Hospital Ampang. Contact number: 03-42896222

Setup Schedule
Setup: Monday - Friday
Service time: 7.30 am to 4.30 pm
### Table 4.1 List of tests offered at Haematopathology Unit

<table>
<thead>
<tr>
<th>Name of test</th>
<th>Indication of Test</th>
<th>Volume required</th>
<th>Special instructions</th>
<th>Collection instruction</th>
<th>Storage and transportation</th>
<th>TAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Bone marrow trephine biopsy (for internal cases only)</td>
<td>Diagnosis of leukaemia &amp; lymphoma, investigate disease infiltration in bone marrow, staging, post chemotherapy</td>
<td>10% neutral buffered formalin must be 20 X of the size of tissue biopsy</td>
<td>None</td>
<td>Immerse trephine biopsy in formalin immediately</td>
<td>Room temperature</td>
<td>14 working days for non complicated cases</td>
</tr>
<tr>
<td>2 Histopathologic examination on tissue biopsy (for internal cases only)</td>
<td>Diagnosis of lymphoma/leukaemia, detection of relapse/ refractory state of disease.</td>
<td>10% neutral buffered formalin must be 20 X of the size of tissue biopsy</td>
<td>Please collect formalin solution from Haematopathology Laboratory prior to biopsy procedure</td>
<td>Immerse tissue biopsy in formalin immediately</td>
<td>Room temperature</td>
<td>14 working days for non complicated cases</td>
</tr>
<tr>
<td>3 Second opinion on histopathologic examination (for internal cases only)</td>
<td>Diagnosis/confirmation of leukaemia or lymphoma</td>
<td>None</td>
<td>Polylysine coated unstained slides required. Minimum of 10; if T cell malignancy suspected-15 will do.</td>
<td>None</td>
<td>Room temperature</td>
<td>14 working days for non complicated cases</td>
</tr>
</tbody>
</table>
5. CYTOGENETICS (LEUKAEMIA) UNIT

**Introductions**

The Cytogenetics (Leukaemia) for Clinical Haematology Referral Laboratory provides cancer cytogenetics services, including routine chromosome diagnostics and advanced molecular cytogenetics (FISH) tests.

Bone marrow cytogenetic evaluation is considered appropriate for patients with neoplastic haematological disorders. Supply 1-2 ml of bone marrow aspirate in sodium heparin vacutainer or bone marrow transport medium.

Cytogenetic evaluation of unstimulated blood samples is appropriate in patients with acquired hematologic malignancy where sufficient neoplastic or with circulating blast cells more than 20%. If the neoplasm is of lymphoid origin then stimulation is needed for B-cells or T-cells. If the blast count or mitotic index is low in the blood, chromosome analysis may be infeasible and interphase FISH could be an alternative (depending on disease type e.g: CLL). Supply 10 ml of peripheral blood in sodium heparin vacutainer or in bone marrow transport medium. Please supply clinical indication (longer turnaround time for B-/T-cell malignancies if mitogen stimulation is indicated).

**Test Indication**

i) **Clinical indications being essential**

Clinical indications are needed to determine test protocols and interpret cytogenetic findings. Clinical history/reasons for referral are required with test order. Prior therapy and transplant history (e.g: donor gender) should be provided with test order. Cytogenetic specimen will not be processed without clinical indications. If you need help for cytogenetic testing, please contact Cytogenetic Lab (603) 4289 6055.

ii) **Clinical indication for haematologic studies**

a) **Acute leukaemia: at diagnosis.**

If an abnormality is present, follow-up after treatment or at relapse. If an abnormal clone is not detected, reinvestigation at relapse may be indicated.

b) **Myelodysplasia (preleukaemia): at diagnosis**

Follow-up may be indicated at disease progression.

c) **Chronic myeloid leukaemia at diagnosis:**

Follow-up at disease progression or to monitor therapy.

d) **Other chronic myeloproliferative disorders:**

At diagnosis and disease progression in selected cases.
e) Malignant lymphoma and chronic lymphoproliferative disorders:
At diagnosis in selected cases and; disease progression in selected cases.

Instruction for submitting sample
A completed HOSPITAL AMPANG SPECIAL LAB HAEMATOLOGY requisition form MUST accompany all specimens.

Please note that incomplete or illegible labeling of forms and/or specimens, or use of incorrect specimen tubes, may result in delays or rejection of specimens.

Sample Requirements
a) Sample for Cytogenetics; Chromosome analysis (Karyotyping) and/or Fluorescence in situ hybridization (FISH).
   - Transport medium is always preferred, however, sodium heparin tube can be used when transport medium is not available.
   - Bone marrow: Place sample (minimum 1-2 ml) in bone marrow transport medium or sodium heparin tube. Bone marrow transport medium is available upon request.
   - Peripheral blood 5 ml. If sodium heparin tube is used send two tubes of 5 ml blood.
   - For CLL case: 10 ml peripheral blood in bone marrow transport medium or sodium heparin tube.

b) Sample Labeling
Specimens should be labeled using a waterproof pen with at least 2 Unique patient identifiers.
   I. Patient’s Full Name (Surname, First name)
   II. Patient identification number (Patient’s Hospital Number /IC / Passport / Military/Police number). Please provide full identification number (e.g IC: 123456-78-9012).

c) The collection date and time, and the origin (source) of the specimen, when applicable. The information on the specimen label should match the information on the lab requisition form.

d) Clinical history, reason for referral, prior therapy and transplant history should be written on the form.

Specimen Handling
Laboratory test results are dependent on the quality of the specimen submitted. Cytogenetics tests are extremely sensitive to methods of collection and preservation. It is important that the sample collection and processing instructions be followed to ensure accurate test results.
Collection Instructions:
1. Invert several times to mix.
2. If ordering both test Karyotyping & FISH (leukemia) analysis, ONE tube is adequate.
3. Other anticoagulants (EDTA, Lithium Heparin) are not recommended as they affect viability of the cells.
   - Bone marrow transport medium is available upon request. Clinical history / reason for referral are required with test order. Prior therapy and transplant history (e.g: donor gender) should be provided with test order.

Storage and Transportation
Samples should never be frozen or refrigerated, and ideally kept at room temperature prior to arrival at the laboratory. Use cold pack but not dry ice for transport, ensure cold pack is not in direct contact with specimen. The specimen must arrive at the lab no later than 24 hours after collection.

Unacceptable Specimen Samples
Samples which are incorrectly collected, labeled, processed, or transported will not produce accurate results. When a sample is found to be unacceptable, Laboratory will notify via telephone. If you have any question prior to collection or transportation of a sample, please contact the appropriate Laboratory unit.

Rejection Criteria
- Fixed or frozen specimens
- Clotted specimen
- Specimen exposed to extreme temperature
- Insufficient number of cells
- Specimens in anticoagulants other than sodium heparin.

Turnaround Time
Average turnaround time is 30 days. For further details or to request expedited testing, please contact the respective Laboratory unit.

Urgent Request
Please contact laboratory during working hours to alert laboratory staff for urgent processing.

Contact
For results dispatch and notification of unacceptable samples, provide name and fax number of Contact person. It will be responsibility of the referring lab to notify us any change in contact person.
Performing Laboratory
Cytogenetics (Leukaemia) Unit. Clinical Haematology Referral Laboratory for Department of Haematology Hospital Ampang. Contact number: 03-4289 6055

Setup Schedule
Setup: Monday-Friday
Service Hours: Regular hours of operation (excluding national & Selangor public holidays and weekends): 7.30am – 5.00pm Monday to Friday.
<table>
<thead>
<tr>
<th>No</th>
<th>Test Name</th>
<th>Method</th>
<th>Specimen Type</th>
<th>Volume Required</th>
<th>Container Type</th>
<th>Specimen Transport Guidelines</th>
<th>TAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bone Marrow Chromosome study</td>
<td>Karyotyping. A minimum of 20 G-banded metaphases studied</td>
<td>Bone marrow aspirate (BMA)</td>
<td>Minimum 1 - 2.0 ml</td>
<td>Sterile transport medium with heparin is always preferred (available from lab)</td>
<td>Transport samples without delay at room temperature. <strong>DO NOT</strong> freeze specimens</td>
<td>30 days</td>
</tr>
<tr>
<td>2</td>
<td>Leukaemia (Neoplasia) Blood Chromosome analysis</td>
<td>Karyotyping. A minimum of 20 G-banded metaphases studied</td>
<td>Peripheral Blood (PB)</td>
<td>Minimum 5.0 ml</td>
<td>Two (2) tubes of transport medium with heparin are required for blood collection (2.5mL in each tube). If transport medium not available, collect sample in sterile <strong>sodium heparin</strong> tube.</td>
<td>Transport samples without delay at room temperature. <strong>DO NOT</strong> freeze specimens.</td>
<td>30 days</td>
</tr>
<tr>
<td>3</td>
<td>Leukaemia FISH analysis (only)</td>
<td>FISH interphase analysis</td>
<td>BMA</td>
<td>Minimum 1 - 2.0 ml</td>
<td>Sterile transport medium with heparin is always preferred (available from lab). Two (2) tubes of transport medium with heparin are required for blood collection (2.5mL in each tube).</td>
<td>Transport samples without delay at room temperature. <strong>DO NOT</strong> freeze specimens.</td>
<td>18 days</td>
</tr>
<tr>
<td>4</td>
<td>Bone Marrow or blood (neoplasia) Chromosome study &amp; Leukaemia FISH analysis</td>
<td>Karyotyping &amp; FISH Interphase analysis</td>
<td>BMA</td>
<td>Minimum 1-2.0 ml</td>
<td>Sterile transport medium with heparin is always preferred (available from lab). Two (2) tubes of transport medium with heparin are required for blood collection (2.5mL in each tube). If transport medium not available collect sample in sterile sodium heparin tube.</td>
<td>One (1) Tube of transport medium with heparin is always preferred. Two (2) tubes of transport medium with heparin are required for blood collection (2.5mL in each tube). If transport medium not available collect sample in sterile sodium heparin tube.</td>
<td>30 days (Karyotyping) FISH (18 days)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Peripheral Blood (PB)</td>
<td>Minimum 5.0 ml (with circulating blasts &gt; 20%) and CLL disease: Minimum 10.0 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6. MOLECULAR DIAGNOSTICS (HAEMATOLOGY) UNIT

Introduction
Molecular haematology laboratory plays a key role in the diagnosis and management of various haematologic malignancies. This laboratory also provides critical information regarding the clinical management of bone marrow transplant patients. The Molecular Diagnostics (Haematology) unit offers molecular testing for acquired haematological disorders. We are a referral laboratory for other hospitals (MOH) throughout the country.

Test indication

1. **Clinical indications being essential**
Clinical indications are needed to determine test protocols and interpret molecular test findings. Clinical history / reason for referral are required with test order. Specimen will not be processed without clinical indications. If you need help for molecular testing, please contact Molecular Diagnostic (Hematology) Lab (603) 4289 6056

2. **Clinical indication for haematologic studies**
   i. Initial (New) diagnosis of all haematopoietic malignancies and chimerism.
   
   ii. Follow-up / MRD Monitoring cases:
      - CML
      - Acute leukemia
      - Chimerism

LIST OF SERVICE
Haematological malignancies cases:
   i. *BCR-ABL1*, Major (p210), Quantitative
   ii. *BCR-ABL1*, Minor (p190), Quantitative
   iii. *PML-RARA*, Quantitative
   iv. *JAK2* (Janus Kinase 2) V617F Mutation Detection
   v. Calreticulin mutation (will do if JAK2 negative)
   vi. FLT3 ITD detection
   vii. NPM1 mutation detection
   viii. Fusion translocation screening
**Instructions for Submitting Samples**

A completed HOSPITAL AMPANG SPECIAL LAB HAEMATOLOGY requisition form MUST accompany all specimens.

Please note that incomplete or illegible labeling of forms and/or specimens, or use of incorrect specimen tubes, may result in delays or rejection of specimens.

**Sample Requirements**

a) Sample for molecular tests:
   - MPN cases – refer to table 6.1
   - Acute leukaemia - refer to table 6.1

b) Sample Labeling

   Specimens should be labeled using a waterproof pen with at least 2 **Unique patient identifiers**.
   i. Patient’s Full Name (Surname, First name)
   ii. Patient identification number (Patient’s Hospital Number /IC / Passport / Military/Police number). Please provide full identification number (e.g IC: 123456-78-9012).

c) The collection date and time, and sample type. The information on the specimen label should match the information on the lab requisition form.

d) Clinical history, reason for referral, prior therapy and transplant history should be written on the form.

**Collection Instructions:**

1. Invert several times to mix blood or bone marrow.
2. A copy of the requisition must be sent with the specimen.

**Storage and Transportation**

Samples should never be frozen. Use cold pack but not dry ice for transport, making sure cold pack is not in direct contact with specimen. Transport sample to the laboratory at room temperature within 24 hours. The specimen must arrive to the laboratory no later than 24 hours after collection.

*Specimens should be delivered to the laboratory as soon as possible after they are taken to ensure the quality of the specimen and the success of the results. Any specimens which have been delayed in transit may not be suitable for processing and may therefore not be accepted by the Laboratory.*
Rejection Criteria
- Frozen specimens
- Clotted specimen
- Specimen exposed to extreme temperature
- Specimens in anticoagulants other than EDTA.
- Sample is hemolyzed.
- Sample is of insufficient volume
- Patient identifiers on sample do not match patient identifiers on the requisition.
- Test not offered
- Test requested is not stated
- Delayed sending specimen
- Wrong sample type e.g Plasma

Performing Laboratory
Molecular Diagnostics (Haematology) Unit. Clinical Haematology Referral Laboratory for Department of Haematology, Hospital Ampang. Contact number: 03-4289 6056

Setup Schedule
Setup: Monday-Friday
Service time: 7.30am to 4.30pm (excluding national & Selangor public holidays and weekends)
<table>
<thead>
<tr>
<th>No</th>
<th>Test Name</th>
<th>Method</th>
<th>Specimen Type</th>
<th>Volume Required</th>
<th>Container Type</th>
<th>Special Instruction</th>
<th>TAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>BCR-ABL1 (*for suspected CML case only)</td>
<td>Qualitative PCR</td>
<td>PB, before starting therapy BM, acceptable</td>
<td>PB, Minimum 5.0 ml BMA, 1-2 ml</td>
<td>K2/K3 EDTA tube</td>
<td>Transport samples without delay preferably within 24 hours at room temperature. DO NOT freeze specimens.</td>
<td>4 weeks</td>
</tr>
<tr>
<td>2.</td>
<td>BCR-ABL1 (*CML AND Ph+ve ALL/AML case )</td>
<td>Quantitative RT-PCR</td>
<td>Follow-up: BMA (acute leukemia)</td>
<td>Minimum 1-2 ml PB preferred</td>
<td>Minimum 10 ml</td>
<td>SM Transport samples without delay preferably within 24 hours at room temperature. DO NOT freeze specimens.</td>
<td>6 weeks</td>
</tr>
<tr>
<td>3.</td>
<td>Minor BCR-ABL1</td>
<td>Quantitative RT-PCR</td>
<td>Follow-up: BMA</td>
<td>Minimum 1-2 ml K2/K3 EDTA tube</td>
<td>BMA or PB</td>
<td>Transport samples without delay preferably within 24 hours at room temperature. DO NOT freeze specimens.</td>
<td>6 weeks</td>
</tr>
<tr>
<td>4.</td>
<td>JAK2 / CALR Calreticulin (this test only carry out if JAK2V617F mutation negative)</td>
<td>Qualitative PCR</td>
<td>BMA or PB</td>
<td>Minimum 1-2 ml Minimum 5.0 ml K2/K3 EDTA tube</td>
<td>BMA or PB</td>
<td>Transport samples without delay preferably within 24 hours at room temperature. DO NOT freeze specimens.</td>
<td>4 weeks</td>
</tr>
<tr>
<td>5.</td>
<td>FLT3-ITD (AML: Diagnosis and follow-up)</td>
<td>Qualitative PCR</td>
<td>BMA or PB</td>
<td>Minimum 1-2 ml Minimum 5.0 ml K2/K3 EDTA tube</td>
<td>BMA or PB</td>
<td>Transport samples without delay preferably within 24 hours at room temperature. DO NOT freeze specimens.</td>
<td>4 weeks</td>
</tr>
<tr>
<td></td>
<td>Test Description</td>
<td>Methodology</td>
<td>Sample Type</td>
<td>Minimum Volume</td>
<td>Transport Information</td>
<td>Timeframe</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------</td>
<td>-------------------</td>
<td>-------------</td>
<td>----------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NPM1 (AML: Diagnosis and follow-up)</td>
<td>Qualitative PCR</td>
<td>BMA/PB</td>
<td>Minimum 1-2 ml</td>
<td>Minimum 5.0 ml K2/K3 EDTA tube, samples transported without delay, preferably within 24 hours at room temperature. <strong>DO NOT freeze specimens.</strong></td>
<td>4 weeks</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>30 fusion genes screening test</td>
<td>Qualitative PCR</td>
<td>BMA/PB</td>
<td>Minimum 1-2 ml</td>
<td>Minimum 5.0 ml K2/K3 EDTA tube, samples transported without delay, preferably within 24 hours at room temperature. <strong>DO NOT freeze specimens.</strong></td>
<td>4 weeks</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>PML-RARA (bcr1, bcr2 &amp; bcr3) [Monitoring]</td>
<td>Quantitative RT-PCR</td>
<td>Initial/Follow-up: BMA</td>
<td>Minimum 1-2 ml</td>
<td>K2/K3 EDTA tube, samples transported without delay, preferably within 24 hours at room temperature. <strong>DO NOT freeze specimens.</strong></td>
<td>6 weeks</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>RUNX1-RUNX1 T1 [Monitoring]</td>
<td>Quantitative RT-PCR</td>
<td>Follow-up: BMA</td>
<td>Minimum 1-2 ml</td>
<td>K2/K3 EDTA tube, samples transported without delay, preferably within 24 hours at room temperature. <strong>DO NOT freeze specimens.</strong></td>
<td>6 weeks</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>CBFβ-MYH11A [Monitoring]</td>
<td>Quantitative RT-PCR</td>
<td>Follow-up: BMA</td>
<td>Minimum 1-2 ml</td>
<td>K2/K3 EDTA tube, samples transported without delay, preferably within 24 hours at room temperature. <strong>DO NOT freeze specimens.</strong></td>
<td>6 weeks</td>
<td></td>
</tr>
</tbody>
</table>
7. BONE MARROW TRANSPLANT UNIT

Introduction
The Bone marrow transplant unit provides a diagnostic service to support the investigation and treatment monitoring for patients in transplant. These include processing of stem cells such as cryopreservation of Peripheral Blood Stem Cell (PBSC), bone marrow and cord blood and storage of stem cells for transplantation.

Test indication
Stem cell transplant is an established form of treatment for a variety of disease such as haematological malignancies, severe inherited hemoglobin disorders, bone marrow failures and severe immune deficiency states.

Instructions for Submitting Samples
A completed HOSPITAL AMPANG SPECIAL LAB HAEMATOLOGY requisition form MUST accompany all specimens.

Please note that incomplete or illegible labeling of forms and/or specimens, or use of incorrect specimen tubes, may result in delays or rejection of specimens.

Sample Requirements

a) Sample of Peripheral Blood Stem Cell (PBSC), bone marrow and cord blood for processing of stem cells and storage of stem cells for transplantation.

b) Sample Labeling
Specimens should be labeled using a waterproof pen with at least 2 Unique patient identifiers.

   III. Patient’s Full Name (Surname, First name)
   IV. Patient identification number (Patient’s Hospital Number /IC / Passport / Military/Police number). Please provide full identification number (e.g IC: 123456-78-9012).

c) The collection date and time, and the origin (source) of the specimen, when applicable. The information on the specimen label should match the information on the lab requisition form.

d) Clinical history, reason for referral, prior therapy and transplant history should be written on the form.

e) Type of samples
Please mention peripheral blood, bone marrow or cord blood.
**Special instruction:**
Test offered to inpatient or cases referred to Hospital Ampang with Approval from Consultant Haematologist Hospital Ampang.

**Storage and Transportation**
Specimen for pre CD34 Enumeration should be received by 7.00 am on the day of enumeration and result will be release by 8.30 am. For Post CD34 Enumeration result will be release in 24 hours.

**Rejection criteria:**
Specimen and test requests will be rejected if:
- Incomplete information on the test request form (clinical history is not provided, incomplete IC no, specimen site is not stated, name of requesting doctor is not stated).
- Unlabelled specimen

**Performing Laboratory**
Bone Marrow Transplant Unit, Clinical Haematology Referral Laboratory, Department of Haematology, Hospital Ampang. Contact number: 03-42896390

**Setup Schedule**
Setup: Monday-Friday
Weekend: Depending on the cases
Service time: 7.00am to 7.00pm
Table 7.1 List of tests offered at Stem Cell Transplant Laboratory

<table>
<thead>
<tr>
<th>No</th>
<th>Test name</th>
<th>Method</th>
<th>Specimen type</th>
<th>Container type</th>
<th>Volume required</th>
<th>Specimen Transport</th>
<th>TAT</th>
</tr>
</thead>
</table>
| 1  | Stem Cell Cryopreservation                    | CD34/CD3 enumeration protocol and 7AAD stem cell viability protocol   | PBSC/ Bone Marrow/ Cord Blood | 1. PBSC in EDTA tube (For CD34 enumeration prior collection)  
2. Stem cells collection in apheresis bag / marrow harvesting bag in Hospital Ampang  
3. Cryopreserved vial / segment (from N2 gas tank in BMT Lab / cord blood bank prior infusion) | 2 ml          | 1. Room Temperature (Fresh collected stem cell)  
2. Cryo-thermos (cryopreserved segment)                                           | 24 hour     |
| 2  | Stem cell derived services include:           | CD34/CD3 enumeration protocol and 7AAD stem cell viability protocol   | PBSC/ Bone Marrow/ Cord Blood | Stem cells collection in apheresis bag / marrow harvesting bag in Hospital Ampang                       | 2 ml          | 1. Room Temperature (Fresh collected stem cell)  
2. Cryo-thermos (cryopreserved segment)                                           | 24 hour     |
| 3  | Full Blood Count                              | FBC Protocol                                                          | Whole Blood / PBSC / Bone Marrow/ Cord Blood | EDTA Tube                                                                                             | 2 ml          | Room Temperature                                        | 1 hour     |
| 4  | Stem Cell Selection                           | Selection Protocol using CliniMacs                                     | PBSC                   | ACDA (in collection bag)                                                                               | > 100 ml       | Room Temperature                                        | 24 hour     |
| 5  | TBNK                                          | TBNK Protocol                                                         | Whole Blood / PBSC     | EDTA Tube                                                                                            | 2 ml          | Room Temperature                                        | 24 hour     |
LIST OF SPECIMEN CONTAINER & TUBES
# LIST OF SPECIMEN CONTAINER/TUBES

<table>
<thead>
<tr>
<th>Unit/Test</th>
<th>Container /Tube</th>
<th>Specimen volume</th>
<th>Rejected Sample Tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>MORPHOLOGY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FBC</td>
<td>K2/K3 EDTA Tube (Purple cap)</td>
<td>Peripheral blood: 2 ml</td>
<td>Lysed sample</td>
</tr>
<tr>
<td>FBP</td>
<td>Neonate EDTA Tube (Purple cap)</td>
<td>Peripheral blood: 250-500 ul</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bijou bottle</td>
<td>CSF/Body fluids: Minimum 1 ml</td>
<td>Blood in CSF tube</td>
</tr>
<tr>
<td>FLOW CYTOMETRY</td>
<td>K2 EDTA Tube (Purple cap)</td>
<td>Peripheral blood/BMA: 3 ml</td>
<td></td>
</tr>
<tr>
<td><strong>Bone Marrow Transport Media</strong></td>
<td>Body fluids (Peritoneal/ Pleural fluids) : Minimum 1ml</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CSF Transport Media</strong></td>
<td>CSF: Minimum 1ml</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>HAEMOSTASIS</strong></th>
<th><strong>Peripheral blood: up to indicated mark</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>PT, aPTT</td>
<td>Number of bottles depend on the test requested; Please refer to Table 3.1</td>
</tr>
<tr>
<td>INR</td>
<td></td>
</tr>
<tr>
<td>D-Dimer</td>
<td></td>
</tr>
<tr>
<td>Fibrinogen</td>
<td></td>
</tr>
<tr>
<td>DIVC screening</td>
<td></td>
</tr>
<tr>
<td>Factor Assay</td>
<td></td>
</tr>
<tr>
<td>ADAMTS</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sodium Citrate 3.2% tube (Blue cap)</th>
<th>Overfilled sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Underfilled sample</td>
</tr>
<tr>
<td>RED CELLS</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>---</td>
</tr>
<tr>
<td><strong>Hb analysis G6PD</strong></td>
<td><strong>K2/K3 EDTA Tube (Purple cap)</strong></td>
</tr>
<tr>
<td><strong>Neonate EDTA Tube</strong></td>
<td><strong>Peripheral blood: 250-500 ul</strong></td>
</tr>
<tr>
<td><strong>EPO level</strong></td>
<td><strong>Peripheral blood (in patient): 3.5 ml</strong></td>
</tr>
<tr>
<td><strong>Plain Tube</strong></td>
<td>If from outsource, spin &amp; separate the serum; minimum 1.5 ml</td>
</tr>
<tr>
<td><strong>Osmotic Fragility Test</strong></td>
<td><strong>Peripheral blood: 4 ml</strong></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Lithium Heparin tube</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>HAEMATO-PATHOLOGY</strong></th>
<th><strong>Recommended trephine length: 2-4 cm</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal container (Trephine)</td>
<td></td>
</tr>
<tr>
<td>Sterile Specimen container (Soft Tissue)</td>
<td></td>
</tr>
<tr>
<td>Volume of formalin &lt; 20X size of trephine</td>
<td></td>
</tr>
</tbody>
</table>

| **CYTOGENETICS** | **BMA : Minimum 1-2 ml**  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Karyotype FISH</td>
<td></td>
</tr>
<tr>
<td>Bone Marrow Transport Media (in patient)</td>
<td></td>
</tr>
</tbody>
</table>
| BMA : Minimum 1-2 ml  
CLL case: 5 ml  
Peripheral blood: 5 ml  
CLL case: 10 ml |  
<p>| EDTA tube |</p>
<table>
<thead>
<tr>
<th>Sodium Heparin tube (Green cap) (Outsource)</th>
<th>Peripheral blood/BMA: Please refer to Table 5.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MOLECULAR</strong></td>
<td></td>
</tr>
</tbody>
</table>
| K2/K3 EDTA Tube (Purple cap) | BMA: Minimum 1-2 ml  
Peripheral blood: Minimum 5.0 ml  
Lysed sample |
| **BONE MARROW TRANSPLANT** |  |
| K2/K3 EDTA Tube (Purple cap) | Peripheral blood/BMA: 2 ml |
| Apheresis bag/Marrow harvesting bag |  |
SPECIMEN REJECTION CRITERIA
SPECIMEN REJECTION CRITERIA

GENERAL
1. Clotted sample
2. Haemolysed sample
3. Delayed sending specimen
4. Deteriorated specimen
5. Duplicate order
6. Empty container received
7. Incomplete information [less than two patient identifiers]
8. Insufficient sample
9. Mislabeled specimen
10. No label
11. No specimen received
12. Patient details on container differ from request form
13. Specimen leakage/ broken container
14. Specimen unaccompanied by form (outsource test)
15. Specimen not in dry ice pack – for EPO & all haemostasis tests.
16. Test not offered
17. Test requested is not stated
18. Wrong anticoagulant
19. Wrong container
20. Wrong specimen type
21. Wrong transport medium
22. Wrong order
23. 'Unmanaged' sample
24. Barcode not readable by scanner

Note:
Please refer to each unit section for specific rejection criteria
HOSPITAL AMPANG
SPECIAL HAEMATOLOGY LAB
REQUISITION FORM
**HOSPITAL AMPANG SPECIAL HEMATOLOGY LAB REQUISITION**

Clinical Hematology Laboratory, Level 2, Hospital Ampang, 60000 Ampang, Selangor.

Lab No:_________ Patient No:_________

**PATIENT**

Name:__________________________

I/C: Male / Female

Age:__________ Maly / Chinese / Indian / Other:__________ Male / Female

Ward:__________ Hospital:__________

**CLINICAL THERAPY & TRANSFUSION HISTORY**

Incomplete clinical history will compromise test interpretation

Fever:☐ jaundice:☐ Bleeding:☐ Transfusion:☐ ESA:☐ Hepatomegaly:☐

Lymphadenopathy:☐ Splenomegaly:☐ Immunosuppression:☐ GCSE:☐

**SAMPLE**

Date of Sampling:__________ 2017

Marrow:☐ Blood:☐ Lymph Node:☐ CSF:☐

Other:☐ Complete one form for each sample type

**MORPHOLOGY 42896532**

- FBP
- Reto/PMP
- CSF
- Body Fluid
- Aspirate
- Trehpaine

**CYTOGENETICS 42896085**

(Transport medium preferred; Na Heparin acceptable)

- FISH:☐ Y Chimerism (Donor: Male / Female)☐
- CLL
- Myeloma
- Hyper eosinophila
- KARYOTYPE

**FLOW CYTOMETRY (EDTA) 42896218**

- Leukemia/ Lymphoma/ Myeloma
- PNH

**MOLECULAR (EDTA) 42896056**

- JAK2V617F
- PML/RARA
- RUNX1/RUNX1T1
- CSF/ MYH11
- BCR/ABL1
- RT3/NPM1
- AML, Mutation Panel
- Chimerism:☐ Pre (donor & recipient)
- POST [2 Hepatic tubes]
- Thalassemia
- Hemophilia
- B/T cell gene rearrangement

**HEMOSTASIS (TRISODIUM CITRATE 3.2%) 42896461**

- DIC screen
- INR
- Fibrinogen
- Factor assay
- D-dimer
- Anti Thrombin
- Protein C
- Protein S
- Anti Xa [LMWH]
- Lupus anticoagulant
- ADAMTS 13

- Platelet aggregation (by appointment only)

**RBC MEMBRANE, HEMOGLOBIN, ENZYME DISORDERS (ACD) 42896217**

- Hb analysis (EDTA)
- sPO2 (plain tube)
- Kleihauer
- Osmotic Frugity (Heparin) (by appointment only)

**HEMATOPATHOLOGY 42896222**

Site of Biopsy:__________________________

Biopsy Type: Excision

Block No:__________

Slides N:__________ Unstained/Stained

OTHER:__________________________

Guidelines on reverse

HA HEMA 2017 12/17/16
### Bone Marrow Procedure Documentation - Lab Use Only

Date & Time of Marrow ____________________________ FBP 

Dr ____________________________ Nurse ____________________________ MLT 

<table>
<thead>
<tr>
<th>Site of Marrow</th>
<th>PSIS Right Left</th>
<th>Condition of Sample</th>
<th>Good Clotted Dry Tap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirate</td>
<td>Trephine</td>
<td>Trephine Roll</td>
<td>Number of smears ____</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cytogenetics Flow Molecular</td>
</tr>
</tbody>
</table>

MGG Date _____ / ____ /17 Time ________ MLT 

### Guidelines for Sampling

**General**  
Any questions/urgent requests please call lab and/or Lab Hematology MO at [call] [contactable via Hospital operator 03-42896000] prior to obtaining sample, especially if sampling on Fridays or eve of Public holidays.  
Invert tube several times to ensure adequate mixing. Transport samples without delay at room temperature [unless otherwise indicated]. Body fluids/CSF should reach lab within 1 hour of sampling. 
Unless otherwise indicated, all tests are available Monday-Friday 8am to 5pm.  

**Bone marrow sample for morphology**  
Bone marrow sample for morphology should be accompanied by a sample for FBP if there has been none in the previous 2 days. To avoid aspiration artifact **ALWAYS obtain trephine sample at a site different from aspiration.**

Flow ☑ 03-4289 6218  

**EDTA Marrow 2 ml; Blood 5 ml**  
**Body Fluids/CSF** sterile plain tube/container without anticoagulant-transport immediately. Body fluid samples for flow should reach lab by 4 pm. These samples can also be transported in cytogenetics culture media.

**Cytogenetics (Karyotyping & FISH) ☑ 03-4289 6055**  
If ordering both tests, one tube is adequate. 
Transport medium is always preferred (available from lab); however, Na Heparin [do not use Li Heparin] can be used if transport medium is not available.

Marrow ~2 ml; Blood 5 ml in sterile transport medium; if Na Heparin is used, send 2 tubes of 5 ml blood.

**Molecular (DNA & RNA) amanglab@gmail.com ☑ 03-4289 6056**  
For Post Transplant Chimerism 2 heparin tubes. 
For BCR/ABL1 monitoring of CML only: send 15 ml of blood. Unstained smear of sample if indicated.

**Hemostasis ☑ 03-4289 6461**  
3.2% Trisodium citrate of 3 ml plasma is required for Factor assays (3 tubes), anti Xa (1 tube) 
Lupus anticoagulant (4 tubes) 
ADAMTS 13 (1 tube) 
Centrifuge sample, aliquot plasma into a new plain tube, freeze immediately at -80°C. Transport frozen in dry ice.