Pathology Services Handbook 2026

Hospital Sungai Buloh

Version 3.0

HOSPITAL SUNGAI BULOH PATHOLOGY SERVICES HANDBOOK

Version 3.0

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Special thanks to;
All personnel of Pathology Department, Hospital Sungai Buloh

COMPLAINTS AND FEEDBACK

PATHOLOGY DEPARTMENT, HOSPITAL SUNGAI BULOH

The laboratory has a documented procedure for handling complaints which describes the process for receiving, substantiating, investigating, tracking, recording, ensuring appropriate action is taken and providing the complainant with the outcome or progress reports.

Complaint relates to laboratory activities are managed similar to any nonconformity. The laboratory ensures that the resolution of complaints will not result in any discriminatory actions and will not compromise impartiality. To raise a complaint or to provide any feedback including regarding the contents of this handbook, please scan the QR code above and fill up the details.

FOREWORD

Pathology services are vital components of diagnostic services that are used in the diagnosis, prognosis, and management of diseases. I am overjoyed that the Department of Pathology has successfully published the Pathology Services Handbook 2026. This comprehensive handbook has proven to be a critical tool, focusing on the test schedules and types of tests available across various disciplines of the Pathology Department which will be used by other facilities throughout Malaysia.

I sincerely hope that this handbook will help to propel our medical service towards the improvement of our diagnostic services, which aim to provide quality and accurate results in a timely manner, thereby improving patient care, management and prognosis. I would like to express my heartfelt congratulations to the Head of the Department of Pathology and the entire pathology team on the successful publication of the handbook. I also hope that this handbook will be useful for making the best use of the laboratory in the near future.

DR. JASMEET SINGH A/L SUCHA SINGH
Hospital Director
Hospital Sungai Buloh

FOREWORD

It is with great pride and commitment that we present the **Hospital Sungai Buloh Pathology Services Handbook 2026**, a comprehensive guide designed to support our team, clinicians, and healthcare partners in delivering quality diagnostic services. As being MS ISO 15189 accredited laboratory, this handbook represents the collective expertise and dedication of our department, aiming to provide accessible, accurate, and timely diagnostic information that are vital to patient care.

Pathology plays a crucial role in clinical decision-making, and our work serves as the cornerstone of accurate diagnosis and effective treatment planning. In this guide, we have outlined and updated comprehensive specimen handling requirements, test schedule with turnaround time including additional new tests, and best practices that uphold the highest standards of quality and safety. Each section has been crafted with attention to detail, user-friendly format to facilitate quick access to crucial information, reflecting our unwavering dedication to precision and continuous improvement.

I would like to extend my sincere gratitude to the entire pathology team for their hard work, collaboration, and commitment to excellence. Your expertise and professionalism drive the success of our department and elevate the quality of care we provide. Additionally, I am grateful to our clinical colleagues, who rely on our insights to make informed, impactful decisions in patient care. It is our hope that this handbook will serve as a valuable resource in enhancing our ability to work efficiently and cohesively. May it guide us in our shared mission to deliver accurate, reliable, and compassionate care to every patient we serve.

DR. SAHLAWATI HJ MUSTAKIM
Head of Pathology Department
Hospital Sungai Buloh

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GENERAL INFORMATION

INTRODUCTION

The Department of Pathology henceforth referred to simply as the laboratory is a part of Hospital Sungai Buloh and a government laboratory under the purview of Ministry of Health (MOH) Malaysia. It is an entity that can be held legally responsible for its activities. The laboratory is accredited to MS ISO 15189 since 2013 and has maintained its accreditation status ever since.

The laboratory is directed by a qualified and competent pathologist who is responsible for the overall laboratory operations. Human resources in the laboratory include pathologists, medical officers, science officers, medical laboratory technologists, clerical staffs and healthcare assistants.

Hospital Sungai Buloh is a government hospital and categorised as a major specialist hospital. It is the centre of excellence for Infectious Disease, Emergency and Trauma as well as Neurosurgery. The hospital serves the districts of Gombak, Petaling and Kuala Selangor. Patients are also referred from government clinics, private clinics and government hospitals in the state of Selangor. The majority of patients are in-patients. It also serves out-patients at the Emergency and Trauma Department and Specialist Clinics.

LOCATION

The laboratory is located at Level 1 of Block B adjacent to the Radiology Department. Visitors and users can access the laboratory via the main entrance. Access to the working areas in the laboratory is limited to the laboratory personnel and authorised personnel.

LABORATORY DIRECTORY

Personnel/ Location	Position/ Unit	Ext. Number
Dr Sahlawati Hj Mustakim	Head of Department	4236
Dr Nur Hanani Ahmad	Head of Unit, Clinical Microbiologist	2149
Dr Adilahtul Bushro Zaini	Clinical Microbiologist	2140
Dr Tuan Suhaila Tuan Soh	Clinical Microbiologist	2130
Dr Nur Izati Mustapa	Clinical Microbiologist	2149
Dr Idimaz Hajar Jabbari	Clinical Microbiologist	2162
Dr Amira Amir	Clinical Microbiologist	2140
Dr Wan Amani Wan Abdul Azim	Clinical Microbiologist	2122
Dr Syarifah Khairul Atikah Syed Kamaruddin	Head of Unit, Chemical Pathologist	7020
Dr Nor Adilah Abdul Rahman	Chemical Pathologist	2161
Dr Firdaus Mashuri	Head of Unit, Haematologist	7020
Dr Nor Khairina M.Kamarudin	Haematologist	2150
Dr Nor Shazwani Abdul Ali	Haematologist	2161
Dr Sarojini A/P Maniam	Head of Unit, Transfusionist	2150
Dr Nusaibah Wan Zulkipli	Transfusionist	2122
Fax Number	Administrative	03-61562645
Clerk/ General Office	Administrative	2104
Medical Officers' Room	Medical Officer (MO)	2141/ 2147
Science Officers' Room	Biochemist	2109/2110
	Microbiologist	2108
Senior MLT	Administrative	2111/ 2114
Common Receiving Area (CRA)		2121
Medical Microbiology	Culture & Sensitivity	2128/ 2129
	Parasitology	2127
	Mycology	2136
	Molecular (PCR / Viral Load)	2131
	Serology / Virology	2139/ 2148
	Media	2132
Chemical Pathology	Laboratory	2119
Haematology	Laboratory	2116
	FBP/ MO in charge	2117
Transfusion Medicine	Laboratory	2154
	MO in charge	2151
Outsource & HPE/ FNAC	MLT in charge	2152
	MO in charge	2141/ 2147

OPERATING HOURS

The laboratory provides 24 hours service in Medical Microbiology (Bacteriology and Parasitology), Chemical Pathology, Haematology and Transfusion Medicine for acute patient management. However, only certain tests are offered after office hours (including weekend and public holiday). For the list of tests offered after office hour, refer to Test Categories section. The laboratory's counter used for receiving specimens also provides 24 hours service.

Molecular Microbiology, Serology and Virology sections operate only during working hours except for urgent molecular, transplants and needle stick injury cases. Medical officers and pathologists on-call are available for consultation and advice after office hours. Their contact numbers are available with the hospital's operator.

Laboratory	Operational Hours	
Medical Microbiology (Bacteriology & Parasitology) **Chemical Pathology** **Haematology** **Transfusion Medicine**	Weekdays (Mon – Fri) Weekends Public Holiday	Open 24 hours
Molecular Microbiology **Serology** **Virology** **except for urgent molecular, transplants and needle stick injury cases*	Weekdays (Mon – Fri) Weekends Public Holiday	8:00 am – 5:00 pm

SCOPE OF SERVICES

The scope of laboratory services includes Chemical Pathology, Medical Microbiology, Haematology and Transfusion Medicine. The service encompasses of:

a) Routine, specialised and urgent tests with specified laboratory turnaround time (LTAT)
b) Outsourcing services for the tests which are not provided by the laboratory
c) Consultancy and advisory services
d) Training for all category of laboratory staff and individuals from other institutions
e) Technical evaluation of reagent kits and analysers
f) Provision of External Quality Assurance (EQA) Program
g) Research and development activities
h) Supervision of point-of-care testing (POCT) via Hospital POCT Committee
i) Supervision of specimen collection sites

In the event of any significant changes to our services or temporary/ permanent suspension of any laboratory tests, the laboratory will promptly notify all affected users. Alternative arrangements or contingency plans (where applicable) will be communicated accordingly.

TEST CATEGORIES

The tests offered by the laboratory are grouped into 4 categories:

Office Hour	After Office Hour Including Weekend & Public Holidays	Batch Tests	By Appointment
Medical Microbiology			
All tests	AFB stain All culture & sensitivity BFMP Body fluid microscopy Clostridium difficile antigen/toxin Cryptococcal antigen CSF microscopy Dengue rapid test Infective screening (needle stick injury and transplant case) MERS Coronavirus Genome Detection Microfilaria (Blood film) Rotavirus SARS-CoV-2 antigen SARS-CoV-2 Genome Detection/ Gene expert Stool for ova & cyst	Molecular Serology Refer to Medical Microbiology Section	
Chemical Pathology			
All tests	All tests except batch tests	FSH, LH, Progesterone, Oestradiol, Testosterone, Prolactin **(Tuesday)** CEA, CA 125, CA 19-9, PSA, AFP **(Tuesday & Thursday)** Folate, Vit B12 **(Wednesday & Friday)**	
Haematology			
All tests	FBC FBP (MO Code is required) PT APTT Fibrinogen D–Dimer ESR G6PD Screening		Specialised test: Bone Marrow Aspiration Bone Marrow Trephine Biopsy Kleihauer test Mixing Test G6PD Assay
Transfusion Medicine			
All tests	All tests need MO code except Coomb's test, ABO Rh grouping and referred tests (i.e.: antibody identification, ABO Rh Confirmation, etc.)		Phenotype Blood for Thalassemia Patient Rhesus Negative for Elective OT Cases Rare phenotype blood (Anti–JK3, etc.)

URGENT TESTS

Urgent test is defined as a test of which the result is likely to influent clinical decision and management of a patient before the result would be routinely reported.

Unit	Urgent Tests
Medical Microbiology	AFB stain BFMP Body fluid microscopy Cryptococcal antigen (first sample) CSF microscopy Dengue rapid test* Infective screening for needle stick injury and organ transplant* * *To call MO Microbiology/ Clinical Microbiologist on-call for urgent requests.* Culture samples: Can only be sent after 4 hours of downtime Immunology, Serology, Virology & Molecular samples: Can only be sent 24 hours after downtime
Chemical Pathology	Acetaminophen Ammonia Beta HCG CSF biochemistry hs-Troponin T Salicylate Urine paraquat Routine tests can be also requested as urgent if clinically indicated for example, BUSE, Creatinine, Bilirubin, ALP, AST, ALT, LDH, Amylase, Calcium, Magnesium, Phosphate, Therapeutic Drug Monitoring (TRO toxicity), Thyroid Function Test (TRO thyroid emergencies), Ferritin (TRO HLH) etc.
Haematology	FBC FBP PT APTT Fibrinogen D–Dimer These are routine tests but can be requested as urgent if clinically indicated
Transfusion Medicine	Group Cross Match (GXM) Urgent/ First stage crossmatching* * *To call MO Blood Bank on duty for codes*

REFERRED TESTS

For the tests which are not provided by the laboratory, referred examinations are arranged with MOH, non-MOH or private laboratories. The laboratory is responsible for facilitating the referral process according to its documented procedures.

There is an established agreement for providing medical laboratory services between the laboratory and the referral laboratories. The referral laboratories are selected based on certain criteria to ensure quality is maintained. The list of referral laboratories and their transport schedule are shown below.

Referral Laboratory	Transport Schedule
Pusat Darah Negara	Daily
Institute for Medical Research, Jalan Pahang, Kuala Lumpur	Monday to Friday
Makmal Kesihatan Awam Kebangsaan, Sungai Buloh	Monday to Friday
Pathology Laboratory, Hospital Kuala Lumpur	Monday to Friday
Pathology Laboratory, Hospital Selayang	Monday to Friday
Pathology Laboratory, Hospital Tunku Azizah	Monday to Friday
Pathology Laboratory, Hospital UITM	Monday to Friday
Institute for Medical Research, NIH Setia Alam	Monday, Wednesday, Thursday
Haematology Laboratory, Hospital Tengku Ampuan Rahimah	Monday, Thursday
Pathology Laboratory, Hospital Tengku Ampuan Rahimah	Monday, Thursday
Haematology Laboratory, Hospital Ampang	Tuesday, Thursday
Pathology Laboratory, Hospital Putrajaya	Wednesday
Pathology Laboratory, Hospital Ampang	Thursday

PRE-EXAMINATION PROCESSES

TEST REQUEST

The laboratory receives electronic request from its internal users (except during system downtime) and hardcopy request from its external users. The laboratory communicates with users where necessary to clarify the user's request. Oral request shall be followed by documented request within a given time.

For electronic request, clinical summary and diagnosis must be clearly entered in the clinical comment and abbreviations are discouraged.

For hardcopy request, the information below **MUST** be filled in completely in the request form:

a. Patient's identification (name, identification card (IC) or passport number, hospital registration number, age and gender)
b. Patient's location (ward/ clinic/ hospital)
c. Relevant clinical summary and diagnosis
d. Drug history, where relevant
e. Name of test requested
f. Type of specimen and anatomic site of origin, where appropriate
g. Specimen collection date
h. Special timing of specimen collected, where relevant
i. Requester's signature and stamp

Incomplete information may delay the sample analysis which subsequently delay the reporting of results.

TEST REQUEST DURING SYSTEM DOWNTIME

System downtime is a condition where the laboratory information system (LIS) cannot be used to perform the laboratory processes that are LIS–assisted.

Only urgent tests can be requested during downtime. Refer to list of Urgent Tests.

Test requests need to be registered, processed and reported manually. The procedure during system downtime can be divided into planned and unplanned downtime:

Planned System Downtime Procedure

Time	Procedures
3 hours before downtime	IT department will disable laboratory orderable. Send all barcoded samples to the laboratory.
2 hours before downtime	Any barcoded samples received by the laboratory will be rejected. Only urgent samples with PER-PAT 301 form will be accepted. All urgent samples must have MO code **EXCEPT** from Emergency and Trauma Department.
After system recover	All samples must be ordered using hospital information system (HIS). Urgent samples received with PER-PAT 301 form will still be analysed by the laboratory.
30 minutes after system recover	Any samples received with PER-PAT 301 form will be rejected by the laboratory.

Unplanned System Downtime Procedure

After 30 minutes of downtime, IT department will activate
BUSINESS CONTINUITY PLAN (BCP) MANUAL FORM

Send all samples using **PER-PAT 301 form (3 copies)**; regardless barcode has already been generated or not, with exception for transfusion; use GXM manual form

Note:

- Send separate PER-PAT 301 form for each unit's test
- All referred samples (without barcode/not registered) during downtime are advised to hold from being sent to the lab until system recover to avoid problem

Fill up PER-PAT 301 form with all the following details:

- Patient's identification data (Name, I/C or passport number, hospital number, age and gender)
- Relevant clinical summary and diagnosis
- History of administration of drug, where relevant
- Ward or clinic and hospital's official rubber stamp
- Name of test requested
- Type of specimen and anatomic site of origin, where appropriate
- Special timing of specimen collected, where indicated
- Doctor's signature and stamp

Note:

Please ensure **LOCATION** is specified as result will be sorted according to location

Collect the hard copy results at the counter

Note:

- Please expect delay in TAT as all processes are done manually
- We do not encourage tracing during downtime as all manpower will be mobilised for manual work processes

SPECIMEN COLLECTION

Before specimen collection, verify the identity of the patient with at least 2 identifiers (i.e., patient's name and IC/ hospital registration number). Verify that the patient meets pre-examination requirements where relevant [e.g., fasting status, medication status (time of last dose, cessation), specimen collection at predetermined time or time intervals]. Obtain patient's consent if indicated.

Preferable site of venepuncture is at the median cubital section of the antecubital fossa. Patient should be in a resting state and has maintained the same position for at least 20 minutes to prevent haemoconcentration. If patient is having intravenous drip infusion, the infusion should be stopped for at least 3 minutes before performing venepuncture on the other arm.

Collect the specimen into appropriate tubes or containers (refer section Specimen Collection Tubes/ Containers). To avoid cross-contamination of additives between tubes, blood must be filled into the tubes in a specific order (refer table **Order of Draw**). Let the vacuum in the tube fill the blood up to its level. Do not press the syringe plunger as this will lead to haemolysis. Gently invert the tube 5-10 times and be sure that the entire inner surface of the blood collection tube is coated with blood while mixing.

Order of Draw

Tube Closure Color	Collection Tube	Mix by Inverting	Min. Clot Time
	Blood Cultures – SPS	8 to 10 times	N/A
	Citrate Tube (Light Blue)	3 to 4 times	N/A
	Serum Separator Tubes (Gold and Tiger)	5 times	30 minutes
	Serum Tube (Red)	5 times (plastic) None (glass)	60 minutes
	Rapid Serum Tube (Orange)	5 to 6 times	5 minutes
	Plasma Separator Tube	8 to 10 times	N/A
	Heparin Tube (Green)	8 to 10 times	N/A
	EDTA Tube (Lavender)	8 to 10 times	N/A
	PPT Separator Tube (Pearl)	8 to 10 times	N/A
	Fluoride Tube (Gray)	8 to 10 times	N/A

Label the specimen in a manner that provides an unequivocal link with the patients from whom they are collected. Specimen must be label appropriately to ensure smooth analysis by the analysers (refer Specimen Labelling section).

Dispose all material used during the specimen collection according to the standard guideline. For external users, the primary specimen shall be separated (where appropriate) and stored in proper storage conditions before the collected samples are delivered to the laboratory.

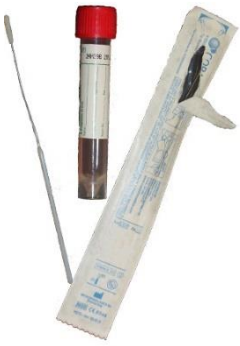
SPECIMEN COLLECTION TUBES/ CONTAINERS

Tube/ Container	Sample/ Tube Description	Common Use	Special Instruction
Adult  **Paediatric** 	**Serum** Serum Separator Tube (SST) or Plain tube with gel	**Chemical Pathology:** Routine chemistry, tumour markers, hormones, special proteins, anaemia profile etc **Medical Microbiology:** Serology tests **Haematology:** Erythropoietin	Mix specimen gently 8 – 10 times Then stand for 15 minutes before centrifuging
	**Serum** Plain tube without gel	**Chemical Pathology:** Antifungal therapeutic drug monitoring (TDM) **Haematology:** Platelet antibody screening **Transfusion Medicine:** Antibody identification	Mix specimen gently 5 – 6 times
Adult 	**Whole blood or plasma** Lithium Heparin	**Chemical Pathology:** Plasma amino acid **Haematology:** Chromosome analysis/ cytogenetic for genetic disease	Mix specimen gently 8 – 10 times

Tube/ Container	Sample/ Tube Description	Common Use	Special Instruction
Paediatric 			
	**Whole blood or plasma** Sodium Heparin	**Haematology:** Cytogenetic for leukaemia (blood and bone marrow aspirate)	Mix specimen gently 8 – 10 times
Adult  **Paediatric** 	**Whole blood or plasma** K2 EDTA	**Chemical Pathology:** HbA1c, ammonia **Medical Microbiology:** Molecular tests **Haematology:** FBC, FBP, reticulocyte count, G6PD screening and assay, Hb analysis, CD4/ CD8, DNA analysis, Keilhauer test **Transfusion Medicine:** GSH, GXM, antibody identification, ABO Rh confirmation, ABO Rh grouping, Coomb's test, transfusion reaction workup, baseline RBC Phenotyping	Mix specimen gently 8 – 10 times

Tube/ Container	Sample/ Tube Description	Common Use	Special Instruction
Adult  **Paediatric** 	**Plasma** Sodium Fluoride	**Chemical Pathology:** Glucose testing	Mix well gently
	**Plasma** 3.2% Sodium Citrate	**Haematology:** PT, APTT, D-Dimer, fibrinogen, mixing test	Mix specimen gently 3 - 4 times Fill until the marked indicator
	**Whole blood** 3.8% Sodium Citrate	**Haematology:** ESR	Mix specimen gently 8 - 10 times Fill within the 2 markers
	Bijou bottle	**Chemical Pathology:** CSF and other body fluid biochemistry **Medical Microbiology:** CSF and other body fluid culture	Ensure cap is tight to prevent specimen leakage

Tube/ Container	Sample/ Tube Description	Common Use	Special Instruction
	Sterile urine container/ universal container	**Chemical Pathology:** Urine and other body fluid biochemistry **Medical Microbiology:** Urine, body fluid tissue, implant (small device such as screw) for culture & sensitivity **Haematology:** Trephine biopsy **Transfusion Medicine:** Transfusion reaction workup **Histopathology:** Small biopsy (add 10% formalin) **Cytology:** FNAC specimen	Ensure cap is tight to prevent specimen leakage **Do not add formalin for tissue culture and cytology specimen**
	24-hour urine container	**Chemical Pathology:** 24-hour urine chemistry	Additives will be added by lab staff depending on the test request
	Stool container	**Medical Microbiology:** Stool for culture, rotavirus antigen and *Clostridium difficile* antigen & toxin	**Do not contaminate stool with urine**
	Sputum cup	**Medical Microbiology:** Sputum for culture & sensitivity and AFB stain	

Tube/ Container	Sample/ Tube Description	Common Use	Special Instruction
	Disposable container	**Histopathology:** Big biopsy/ surgical specimen (add 10% formalin)	
	Amies transport media	**Medical Microbiology:** Swab for culture (high vaginal swab, eye, ear, nasal swab etc)	
	Viral transport media (VTM)/ universal transport media (UTM) and Dacron swab	**Medical Microbiology:** Swab for viral/ bacterial PCR (throat and nasopharyngeal swab) and viral isolation	For Rapid Test Kit (RTK) Antigen for Covid, no need VTM
	Myco F/Lytic Bottle	**Medical Microbiology:** Fungal and Mycobacterium	Mix with swirling method **Do not store in the refrigerator**

Tube/ Container	Sample/ Tube Description	Common Use	Special Instruction
Adult  **Paediatric** 	Blood culture bottle (aerobic/ anaerobic)	**Medical Microbiology:** Blood culture **Transfusion Medicine:** Transfusion reaction workup (for blood bag only)	Mix with swirling method **Do not store in the refrigerator**

SPECIMEN LABELLING

Tube	Sticker Orientation	Examples
ESR	Horizontal	
Blood Tubes	Vertical	
Paediatric Blood Tubes	Vertical	
Blood Culture Bottles	Vertical **DO NOT** cover the barcode on the bottle	

SPECIMEN TRANSPORTATION

To ensure the timely and safe transportation of specimens, collected specimens should be put in biohazard plastic bag before delivery to the laboratory. For referred tests, the biohazard plastic bag should be stapled together with the accompanied request form.

Collected specimens must be sent immediately to the laboratory via porter, courier service or pneumatic tube.

Tests or specimens that **cannot be sent via pneumatic tube** are:

a. Histopathology and cytology
b. Blood and urine for culture and sensitivity
c. 24-hour urine specimens
d. Ammonia
e. Transfusion Reactions Workout
f. Blood and blood product
g. ESR
h. Specimen in universal container
i. CSF in bijou bottle

For sample transportation using courier service, samples' temperature shall be maintained and monitored by the referring laboratories to secure the samples integrity. The laboratory shall periodically evaluate the adequacy of sample transportation systems and communicate any issues with related parties.

SPECIMEN RECEPTION

Specimens are received at the Central Receiving Area (CRA) which serves as the centralised counter for the laboratory, except for Transfusion Medicine service, which have a separate receiving counter adjacent to the CRA. In CRA the laboratory receives, register, evaluate the request suitability, sort and process the specimens before the samples are sent to specific laboratories for analysis. Here, the laboratory also supplies special containers or preservatives for certain tests.

The laboratory has procedures and appropriate facilities for securing patient samples, ensuring sample integrity and preventing loss or damage during handling, preparation and storage. The laboratory does not encourage additional examination requests on the same sample in view of sample integrity.

Note: Please make sure the time specimen received by the laboratory's counter is clocked in by the sender. Please use the clock timer available at the counter.

REJECTION CRITERIA

Test requests will be screened for suitability at the CRA upon receipt before the specimens are sent to the respective unit for analysis. In the respective unit, the test requests will be screened again. The laboratory rejects samples that do not fulfil the criteria and informs the requester. Rejection can be done pre-analysis, during analysis and post-analysis.

The laboratory indicates in the examination report when a compromised clinically critical or irreplaceable sample is accepted and advises caution when interpreting results that can be affected. While most rejection criteria are general, some are unit specific. The reasons of rejection are as listed below:

General Rejection

1. Aged sample
2. Blood clotted
3. Blood haemolysed
4. Contaminated specimen
5. CSF heavy blood stained
6. Duplicate order
7. Double sticker of different ID
8. Empty container received
9. Icteric serum received
10. Improper barcode labelling
11. Incomplete request form
12. Incorrect information
13. Insufficient sample
14. Lipemic blood received
15. Mislabelling of specimen
16. Need separated barcode
17. No clinical history
18. No clinical indication
19. No patient diagnosis
20. No request form attached
21. Wrong test ordered
22. No requesting Dr's name/ name not clear
23. Order cancelled by doctor
24. Specimen leakage
25. Specimen not in ice
26. Specimen not received
27. Temporarily no reagent
28. Test not offered
29. Test requested not stated
30. Need separate tube
31. Tube/ container not labelled
32. Tube cracked/ broken while spinning
33. Unsuitable sample for analysis
34. SYSTEM house cleaning
35. Cannot read barcode
36. Wrong container/ tube
37. Wrong request form
38. Lost specimen
39. Expired tube

Special Rejection

Chemical Pathology

1. 24-hour urine collection < 500ml
2. HbA1C request - less than 3 months
3. Interface down
4. Mucoid specimen
5. Total urine volume for 24 hrs urine metanephrine < 750ml
6. Urine pH >4 for 24 hrs urine metanephrine

Medical Microbiology

1. AFB > 3 samples sent
2. Salivary sputum – unsuitable for culture
3. Wrong transport medium

Haematology

1. CD4/CD8 – less than 4 months
2. CD4/CD8 received not at ambient temperature
3. Delayed in sending FBC more than 4 hrs
4. Delayed in sending FBP more than 4 hrs
5. Delayed in sending PT/APTT more than 4 hrs
6. No MO code (FBP) after office hour
7. Specimen received on Friday/ eve of PH > 12 PM (CD4/CD8)
8. Inappropriate sample-anticoagulant volume ratio

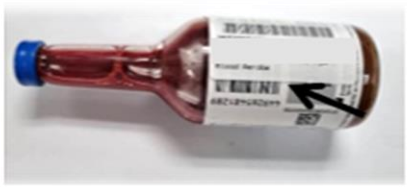
Transfusion Medicine

1. Delayed in sending GSH/ GXM > 4 hours
2. No MO codes
3. No mother's specimen received
4. Test not done (empty blood bag received)

Histopathology

1. Insufficient formalin

Example of Unreadable Barcode

Descriptions	Examples
Poor distribution of ink on the barcode has resulted in some white spots within the bar elements, which may lead to readability issues. **Contact IT Department if this happens.**	
Barcode pasted horizontally or slanted	
Barcode pasted on the cap	
Overlapped barcode	
Barcode pasted on the blood culture bottle's barcode	

EXAMINATION PROCESSES

The laboratory selects and uses validated examination methods to assure the clinical accuracy of the examination for patient testing. The laboratory verifies that it can properly perform examination methods before introducing into use, by ensuring that the required performance, as specified by the manufacturer or method, can be achieved. If the method is revised by the manufacturer, the laboratory will repeat verification to the extent necessary.

The laboratory evaluates measurement uncertainty (MU) of measured quantity values. MU evaluations are regularly reviewed, and MU information is made available to laboratory users upon request.

The laboratory defines biological reference intervals and clinical decision limits for interpretation of its examination results. These intervals and limits are periodically reviewed.

The laboratory monitors the validity of its examination results which include internal quality control (IQC), external quality assessment (EQA) and comparability of examination results. Any nonconformity identified during the monitoring of IQC, EQA and comparability of examination results will be investigated, corrected, documented and communicated to users as appropriate.

POST-EXAMINATION PROCESSES

REPORTING AND TRACING OF RESULTS

Reporting of Results

For internal users, results requested via HIS can be viewed in the HIS. For external users, results are emailed to the referring laboratories.

Tracing of Results

Result tracing will only be entertained if the result has exceeded LTAT. Please refer to each test's LTAT in respective unit section.

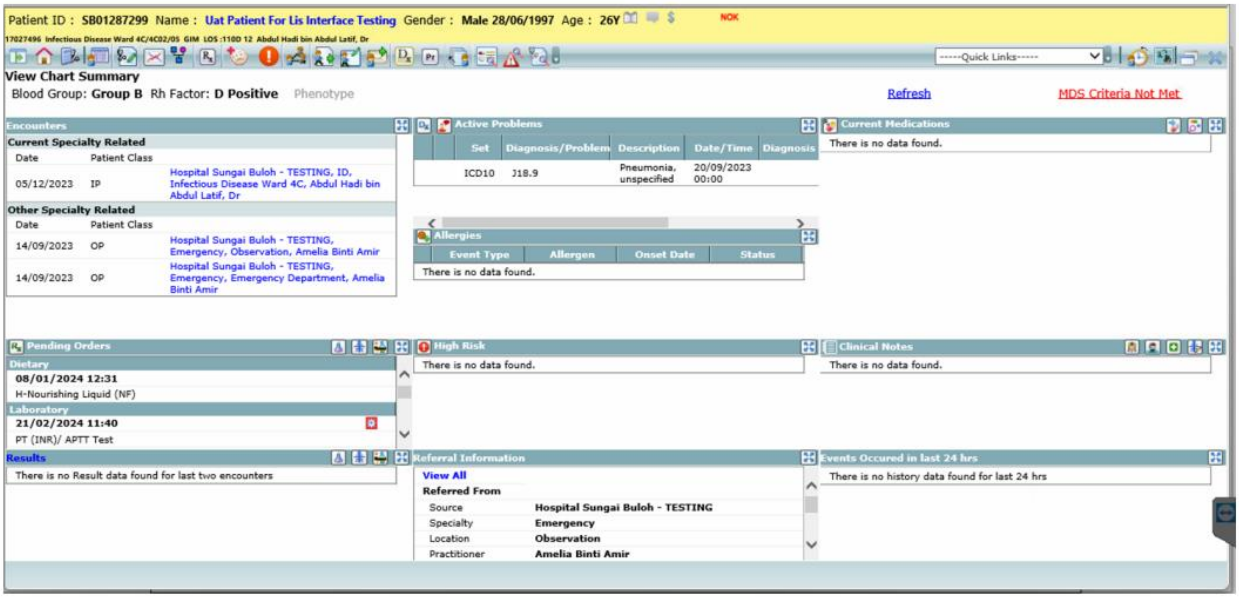
Any inquiry regarding **result OR preliminary report**, kindly call the **RESPECTIVE** unit i.e., Chemical Pathology, Medical Microbiology, Haematology, Transfusion Medicine and Histopathology/ Cytology. Refer to Laboratory Directory section.

For external laboratories, any request for lab result tracing shall be submitted via official email or letter. Phone request is discouraged to ensure proper documentation.

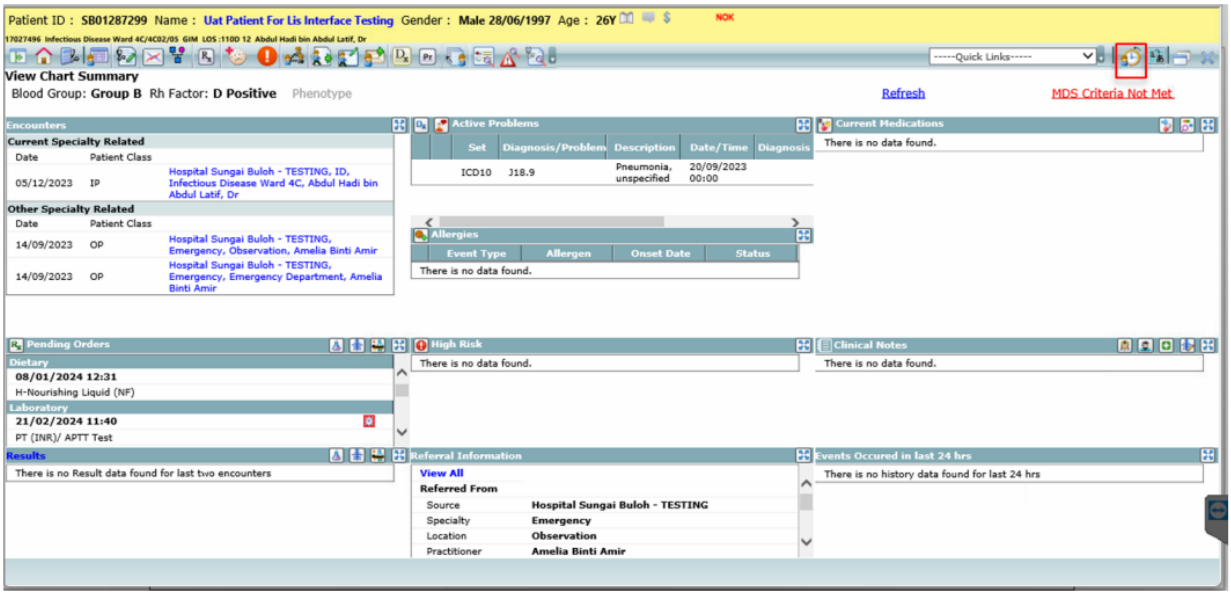
The diagram below illustrates the steps to search and view laboratory results in the Clinical Event History of HIS system.

1 How to search laboratory result at Clinical Event History

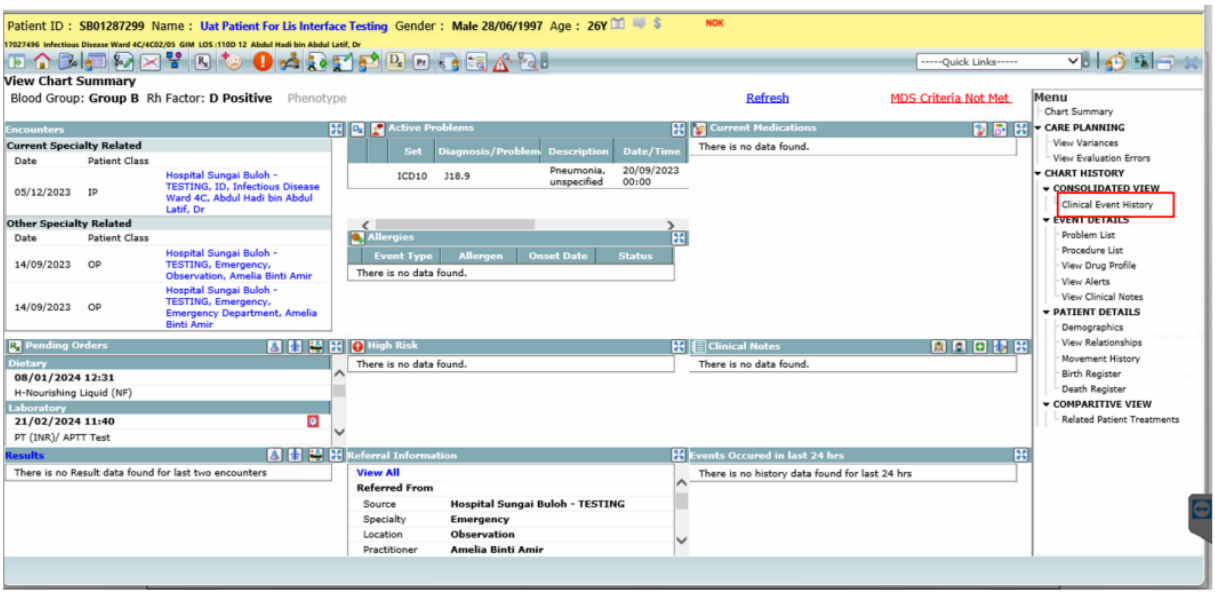
1. Open Patient chart



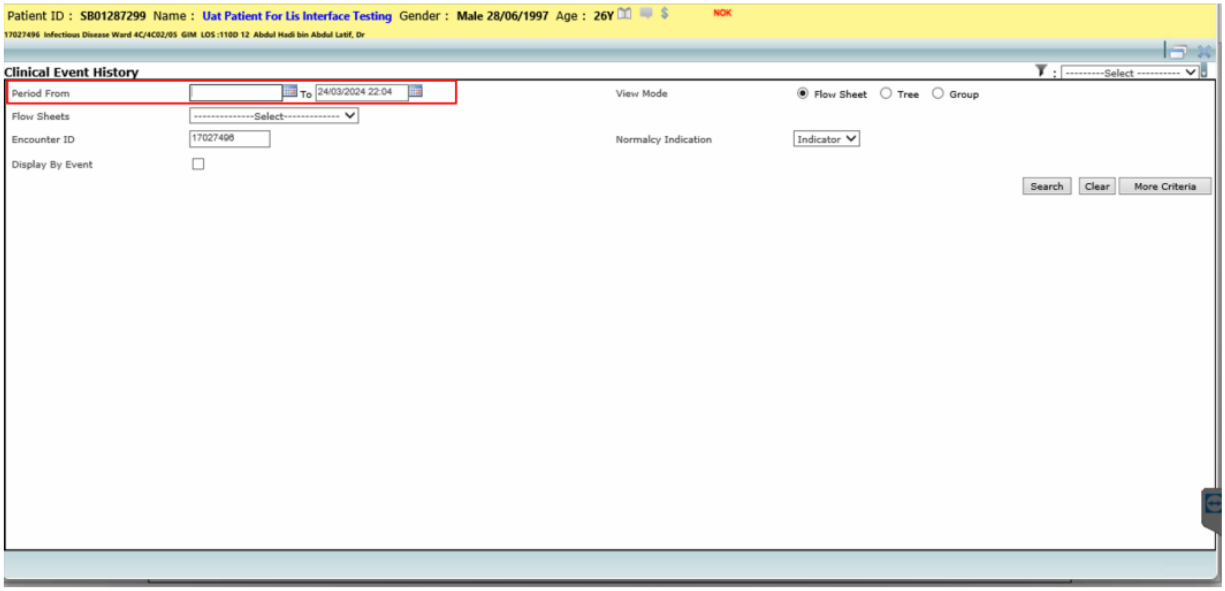
2. At the right corner, click this icon 



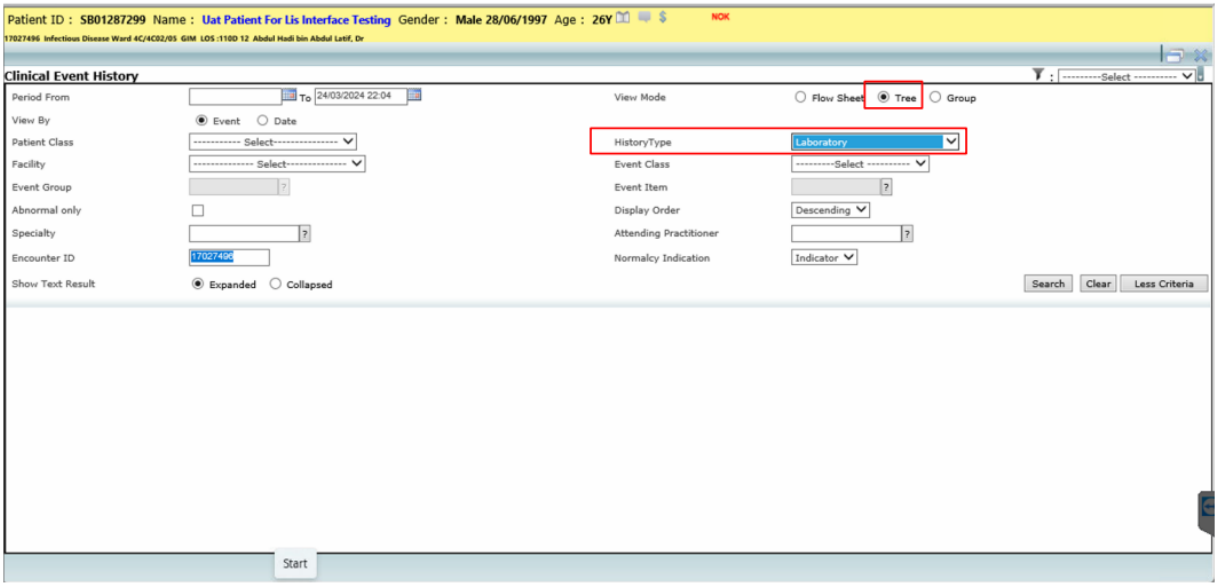
3. Select Clinical Event History



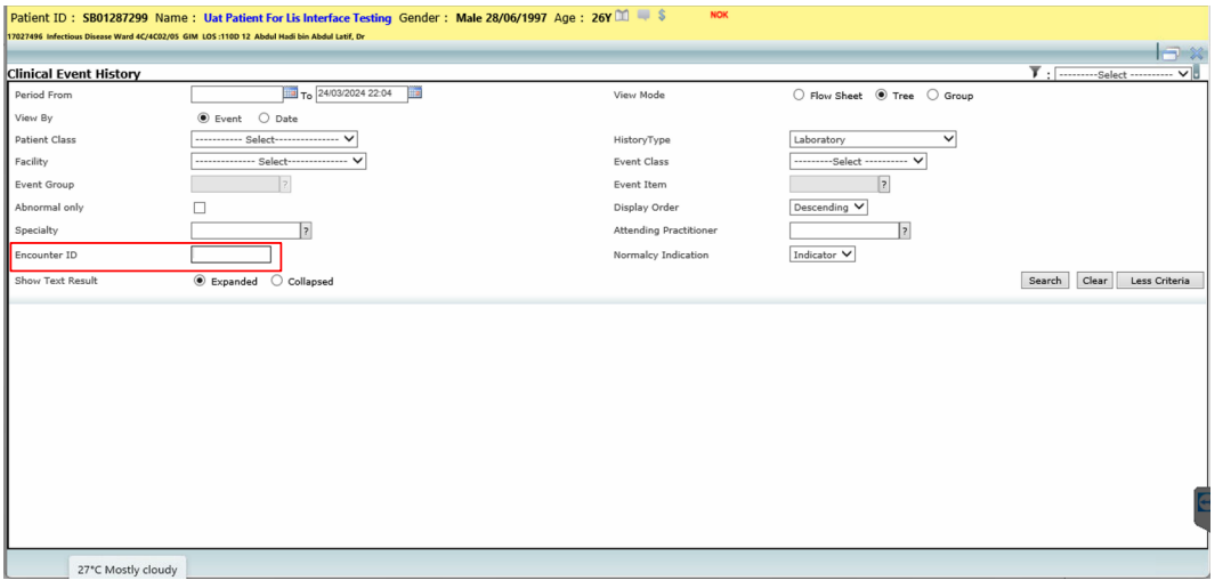
4. Remove date at Period From



5. View Mode = Tree, History Type = Laboratory



6. Clear data at Encounter ID

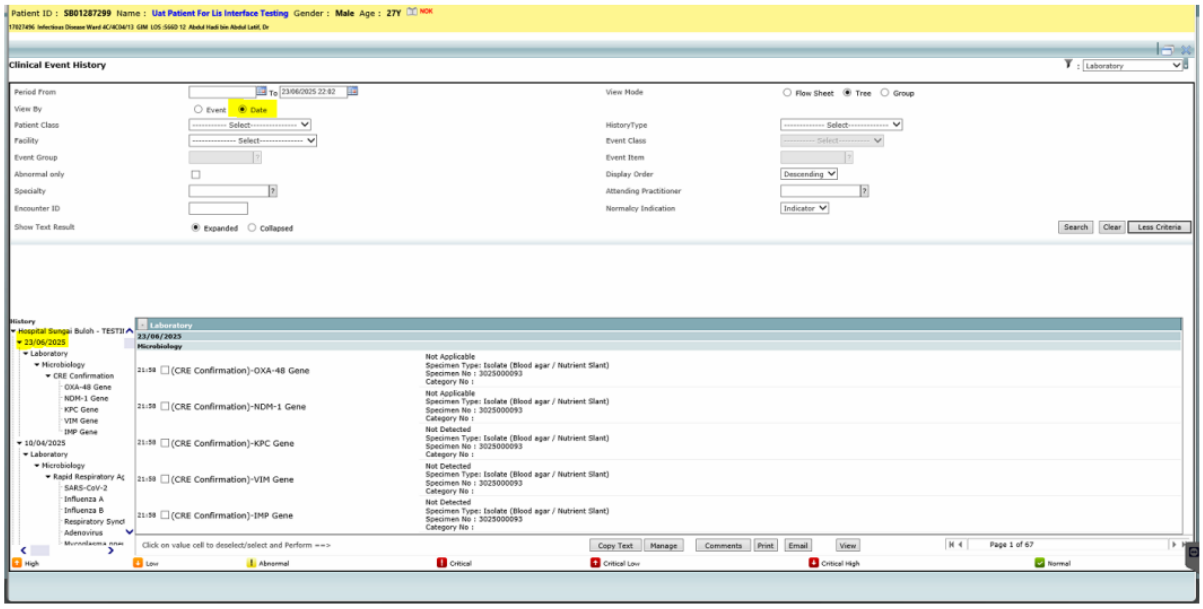


7. Click Search

8. Data appeared as below. User can search the result.

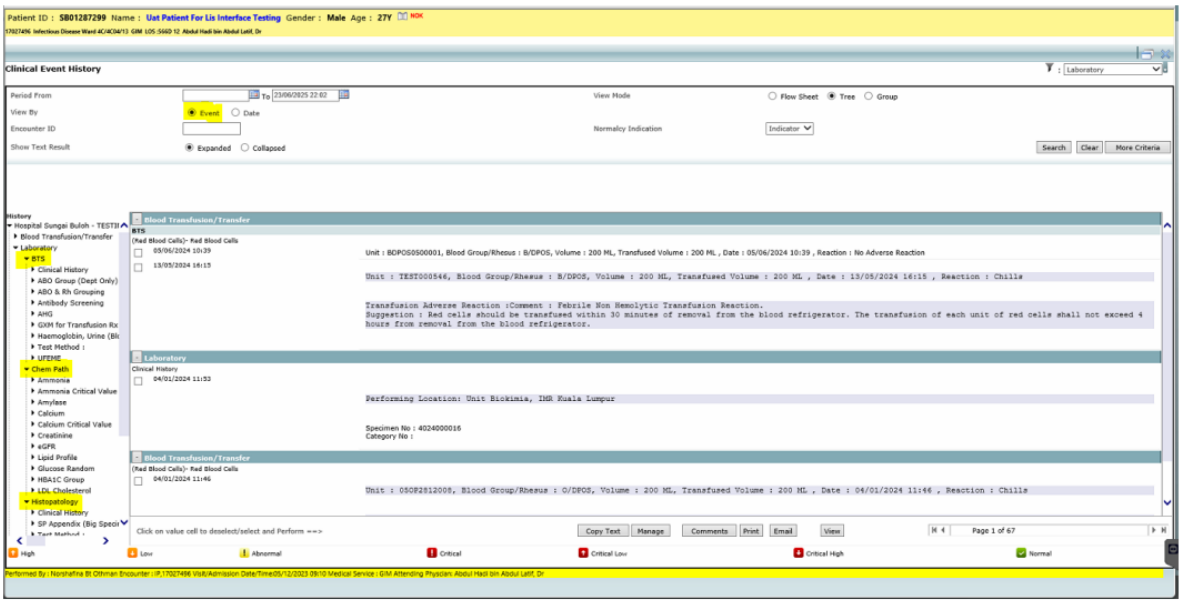
➢ View by date

It will sort the latest specimen date first, followed by the next day's specimens



- View by Event

  It will sort by unit in Pathology and the Test (alphabatical order)



CRITICAL RESULTS NOTIFICATION

All critical results shall be notified to respective ward or clinic once the resultis ready. Refer to list below for the critical results.

Test	Critical Limit	
	Lower Limit	Upper Limit
Potassium	< 2.5 mmol/L	> 6.0 mmol/L
Sodium	< 125 mmol/L	> 155 mmol/L
Calcium	< 1.5 mmol/L	> 3.0 mmol/L
Ammonia	-	> 100 µmol/L
Bilirubin, Total	-	> 300 µmol/L
TSH, neonatal	-	≥ 20 mIU/L
FT4, neonatal	≤ 15 pmol/L	-
Haemoglobin	≤ 6.0 g/dL	-
Platelet	≤ 20 X 10^9 /L	-
AFB	1st positive result	
BFMP	1st positive result	

Critical Result Notification Policy

1. Only **first-time** critical value will be notified.
2. The **authorized recipients** shall only be doctor, medical officer assistant or nurse.
3. Result shall be reported according to the **location specified** on the form/ request. It is the responsibility of the requester to inform the subsequent ward where the patient was transferred.
4. If location is not specified, result shall not be informed.
5. The **first person** who receives the notification shall accept and take the call even though the patient is not under his/her care. The same applies in the event the patient has transferred to other location.

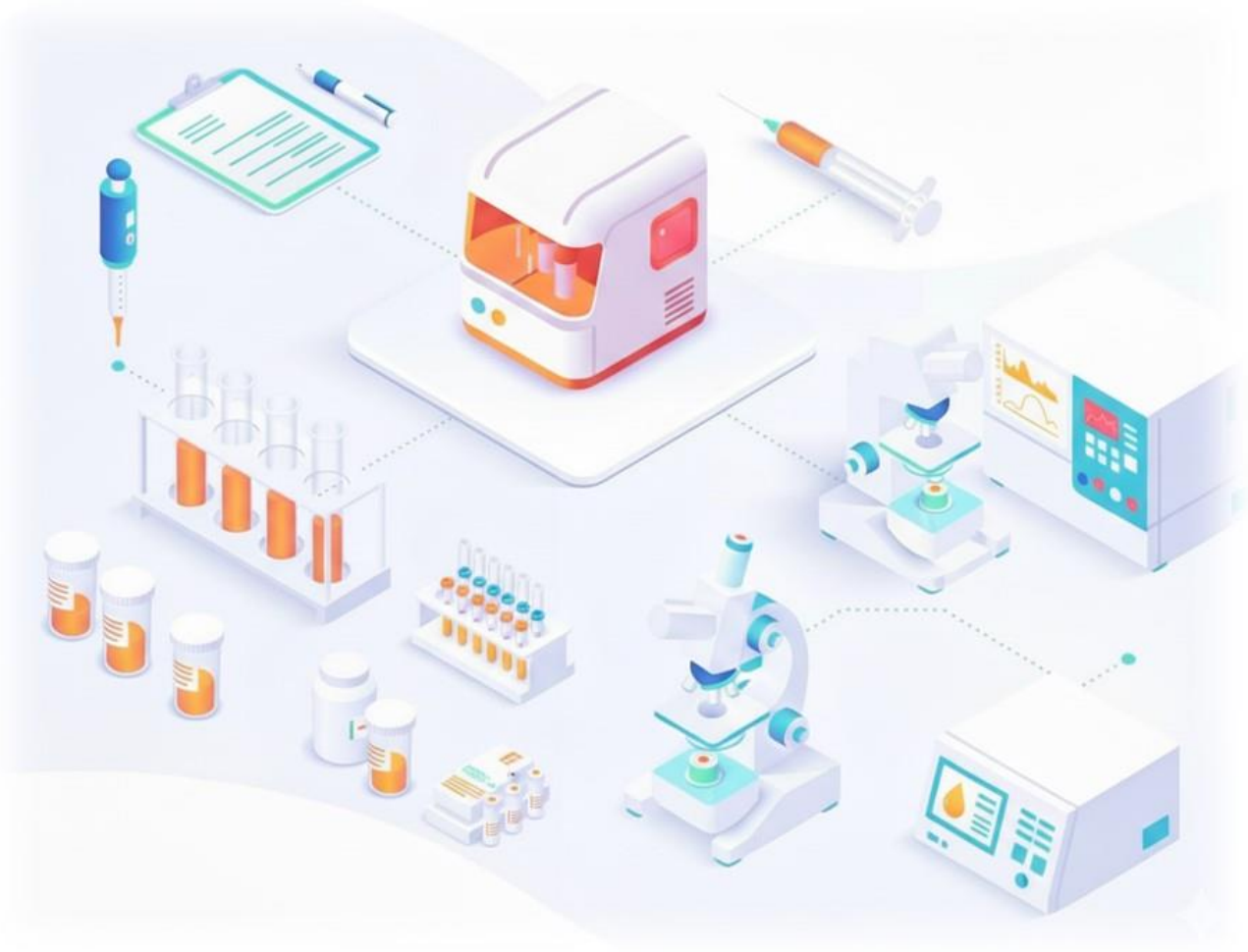
AMENDMENT OF REPORTED RESULTS

In circumstances where reported results need to be amended, the laboratory shall notify the requester of the revision and the reason for the change.

POST-EXAMINATION SAMPLES HANDLING

Post examination samples are retained and stored under specified conditions to ensure samples are suitable for repeat analysis and additional examination.

CHEMICAL PATHOLOGY



INTRODUCTION

Services offered by the unit include general chemistry, endocrine, metabolic, protein, tumour markers, therapeutic drug monitoring and clinical toxicology. The tests offered in-house are stated in List of Tests (In-House) and the test referred are stated in List of Tests (Referred).

All analytes are monitored by external assurance schemes including RCPA and RIQAS. A full programs of internal quality assurance also operates. All reports are reviewed by the chemical pathologist, medical officers, clinical biochemist and medical lab technologists; and clinical interpretation are provided by the chemical pathologist when appropriate.

FACTORS AFFECTING TEST RESULTS

There are many factors which may cause an interference in the performance of a test including physiological aspects such as age and sex of the patient, whether patient is supine or erect, fasting or non–fasting. In general, reference ranges will allow for these factors. The table below indicates some common analytical factors which can cause an interference, but the list is by no means exhaustive.

Factors	Precautions
Haemolysis	Avoid shaking blood tubes which may cause trauma to the red cells (for tubes containing anti-coagulant, gently invert the tubes 3 times immediately on collection) Never inject a syringe needle into the vacutainer to empty the syringe Avoid extremes of temperature Haemolysis badly affects potassium, folate, bilirubin, AST, ALT, LDH, CK, Mg, PO4
Contamination	Avoid taking blood from the arm where an IV infusion has been set up, which can cause a dilution effect of most analytes also depending on the infusion may increase glucose, sodium, chloride and potassium levels Avoid decanting blood from one tube to another. Blood requiring K^+EDTA preservative must be taken after specimens for chemistry tests (serum separator tubes, SST). K^+EDTA will badly affect potassium, calcium, ALP
Venous constriction	Avoid a tourniquet where possible or at least keep its use to a minimum. Constriction can badly affect calcium, lactate, electrolytes, proteins
Icterus	Icterus can badly affect creatinine, cholesterol, ammonia and triglycerides
Lipemia	Lipemia can badly affect sodium, ammonia, ALT, AST and salicylate
Drugs	It is not possible to list all the drugs that may cause interference in analysis. Advice can be obtained from the clinical laboratory staff if required
Delay in sending of specimens (more than 4 hour)	Delay in sending of specimens can cause significant changes in analyte concentrations. The most commonly affected analyte is potassium, but others could also be affected
Incorrect specimen received	Ensure the correct blood collecting tube is used to take the specimen

MEASUREMENT UNCERTAINTY

Chemical Pathology tests are subjected to a degree of uncertainty in their measurement. This may be due to a variety of factors including:

a. Biological variation within individuals
b. Analytical measurement imprecision
c. Pre-examination factors

Please contact the Chemical Pathology unit if you wish to know or discuss the uncertainty values for each analyte measured in the laboratory.

LIST OF TESTS (IN-HOUSE)

Test	Sample Container	Sample Volume	LTAT	Reference Interval	Remarks
Acetaminophen*	Plain tube	3 ml	**Urgent:** 90 minutes **Routine:** 4 hours	**Normal therapeutic range:** 10-30 ug/mL *Conversion factors:* *µg/mL x 6.62 = µmol/L* *µg/mL x 1.0 = mg/L*	Toxic concentrations can be more effectively related to post dose interval; >200, >100, and >50 ug/mL serum concentrations corresponding to toxic concentrations at 4, 8, and 12 hours post dose, respectively
Alanine Transaminase (ALT)*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	**Males:** 10-50 U/L **Females:** 10-35 U/L	
Albumin (serum)*	Plain tube	3 ml	6 hours	**Adults:** 35-52 g/L **Newborn** (0-4 days): 28-44 g/L **Children** (4 days–14 years): 38-54 g/L (14–18 years): 32-45 g/L	
Albumin (body fluid)	Sterile container	3ml	6 hours	Methodology of analysis for body fluid is not validated. Thus, reference range is not available.	Inform laboratory before sending
Alkaline Phosphatase (ALP)*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	**Adults** Males: 40-129 U/L Females: 35-104 U/L **Children** Males (0-14 days): 83-248 U/L (15 days- <1 year): 122-469 U/L (1- <10 years): 142-335 U/L (10- <13 years): 129-417 U/L (13- <15 years): 116-468 U/L (15- <17 years): 82-331 U/L (17- <19 years): 55-149 U/L Females (0-14 days): 83-248 U/L (15 days- <1 year): 122-469 U/L (1- <10 years): 142-335 U/L (10- <13 years): 129-417 U/L (13- <15 years): 57-254 U/L (15- <17 years): 50-117 U/L (17- <19 years): 45-87 U/L	

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

Test	Sample Container	Sample Volume	LTAT	Reference Interval	Remarks
Alpha Fetoprotein (AFP)*	Plain tube	3 ml	5 working days	0.908-7.000 ng/mL	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Tue & Thur
Ammonia*	EDTA tube (**ONLY** accept 2 ml tube)	2 ml	**Urgent:** 90 minutes **Routine:** 4 hours	**Males:** 16-60 umol/L **Females:** 11-51 umol/L	**TRANSPORT IN ICE** and send immediately to lab
Amylase*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	28-100 U/L	
Amylase (urine) (Diastase)*	Sterile container	5 ml (random)	6 hours	**Males:** 16-491 U/L **Females:** 21-447 U/L	
Anti-streptolysin 'O' Titre (ASOT)	Plain tube	3 ml	1 working day	Cut off for **Adults:** ≤200 IU/mL **Children:** ≤150 IU/mL	Elevated values above the cut off by age are consistent with antecedent infection by group A streptococci
Aspartate Transaminase (AST)*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	**Males:** 10-50 U/L **Females:** 10-35 U/L	
Beta HCG (Quantitative)*	Plain tube	3 ml	**Urgent:** 90 minutes **Routine:** 4 hours	**Non-pregnant premenopausal women:** <1.0 mIU/mL **Post-menopausal women:** <7.0 mIU/mL **Men:** 0.2-2.0 mIU/mL	
Bilirubin, Direct*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	1.2-3.4 umol/L	
Bilirubin, Total*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	**Adults** Males: 2.5-24.0 µmol/L Females: 2.5-15.0 µmol/L **Children** 4 days-1 month: 2.5-17.0 µmol/L **Newborn** 24 hours: 2.5-137.0 µmol/L 48 hours: 2.5-222.0 µmol/L 84 hours: 2.5-290.0 µmol/L	
Body Fluid Biochemistry • Glucose • LDH • Protein	Sterile container	3 ml	1 working day	Methodology of analysis for body fluid is not validated. Thus, reference range is not available.	
C-Reactive Protein (CRP)*	Plain tube	3 ml	6 hours	Adults: 0.06-0.50 mg/dL	Interval between order is 24 hours. Please call Pathology MO/Specialist if indicated.
Calcium*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	**Children** (0-10 days): 1.90-2.60 mmol/L	

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

Test	Sample Container	Sample Volume	LTAT	Reference Interval	Remarks
				(10 days- 2 years): 2.25-2.75 mmol/L (2-12 years): 2.20-2.70 mmol/L (12-18 years): 2.10-2.55 mmol/L **Adults** (18-60 years): 2.15-2.50 mmol/L (60-90 years): 2.20-2.55 mmol/L (>90 years): 2.05-2.40 mmol/L	
Calcium (urine)*	Sterile container 24-hr urine container	5 ml (random) At least 500 ml (24-hr)	1 working day	**24-hour:** 2.5-7.5 mmol/day	With normal food intake
Cancer Antigen (CA 19–9)*	Plain tube	3 ml	5 working days	2-27 U/mL	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Tue & Thur
Cancer Antigen (CA 125)*	Plain tube	3 ml	5 working days	0.6-35.0 U/mL	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Tue & Thur
Carbamazepine	Plain tube	3 ml	**Urgent:** 1 day **Routine:** 3 days	**Therapeutic range** 16.9-50.8 µmol/L *Conversion factors:* *µg/mL x 4.23 = µmol/L* *µg/mL x 1.0 = mg/L*	Peak concentrations above 50.8 µmol/L are often associated with toxicity
Carcinoembryonic Antigen (CEA)*	Plain tube	3 ml	5 working days	0.3-5.2 ng/mL	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Tue & Thur
Chloride (CSF)	Bijou bottle/ Sterile container	1 ml	**Urgent:** 90 minutes **Routine:** 4 hours	**Infants:** 110-130 mmol/L **Adults:** 118-132 mmol/L	**Reference:** Tietz Clinical Guide to Lab.Test
Chloride (serum)*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	98-107 mmol/L	
Chloride (urine)*	Sterile container 24-hr urine container	5 ml (random) At least 500 ml (24-hr)	1 working day	**24-hour:** 110-250 mmol/day	
Cholesterol, Total*	Plain tube	3 ml	6 hours	≤5.2 mmol/L	**Reference:** Malaysian Clinical Practice Guidelines Management of Dyslipidaemia 2023

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

<table>
<tr><th>Test</th><th>Sample Container</th><th>Sample Volume</th><th>LTAT</th><th>Reference Interval</th><th>Remarks</th></tr>
<tr><td>Cholesterol, HDL*</td><td>Plain tube</td><td>3 ml</td><td>6 hours</td><td>Males: ≥1.0 mmol/L

Females: ≥1.2 mmol/L</td><td>Reference:
Malaysian Clinical Practice Guidelines Management of Dyslipidaemia 2023</td></tr>
<tr><td>Cholesterol, LDL</td><td>-</td><td>-</td><td>6 hours</td><td colspan="2">
<table>
<tr><th colspan="2">Target LDL-C Levels</th></tr>
<tr><th>Global Risk</th><th>Target LDL-C Levels (mmol/L)</th></tr>
<tr><td>Low CV Risk
<10% 10-year CVD risk</td><td>< 3.0</td></tr>
<tr><td>Intermediate (Moderate) CV Risk
• 10-20% 10-year CVD risk
• Diabetic <50 years old and <10-year duration and no CV risk factors</td><td>< 2.6</td></tr>
<tr><td>High CV Risk
• >20% 10-year CVD risk
• Diabetes >10-year duration without target organ damage + 1 other CV risk factor
• CKD with eGFR 30 - <60 ml/min^{-1}/1.73m^2</td><td>≤ 1.8
and a reduction of >50% from baseline</td></tr>
<tr><td>Very high CV risk
• Established CVD
• Diabetes with CVD or other target organ damage or >3 CV risk factors
• CKD with eGFR <30ml/min^{-1}/1.73m^2</td><td>≤ 1.4
and a reduction of >50% from baseline</td></tr>
<tr><td>Those with recurrent CV events within 2 years despite achieving LDL-C target of <1.4 mmol/l</td><td>< 1.0</td></tr>
</table>
Reference:
Malaysian Clinical Practice Guidelines Management of Dyslipidaemia 2023</td></tr>
<tr><td>Cholesterol, non-HDL</td><td>-</td><td>-</td><td>6 hours</td><td colspan="2">
<table>
<tr><th colspan="2">Target Non-HDL-C Levels</th></tr>
<tr><th>Global Risk</th><th>Target Non-HDL-C Levels (mmol/L)</th></tr>
<tr><td>Low CV Risk
<10% 10-year CVD risk</td><td>< 3.8</td></tr>
<tr><td>Intermediate (Moderate) CV Risk
• 10-20% 10-year CVD risk
• Diabetic <50 years old and <10-year duration and no CV risk factors</td><td>< 3.4</td></tr>
<tr><td>High CV Risk
• >20% 10-year CVD risk
• Diabetes >10-year duration without target organ damage + 1 other CV risk factor
• CKD with eGFR 30 - <60 ml/min^{-1}/1.73m^2</td><td>≤ 2.6
and a reduction of >50% from baseline</td></tr>
<tr><td>Very high CV risk
• Established CVD
• Diabetes with CVD or other target organ damage or >3 CV risk factors
• CKD with eGFR <30ml/min^{-1}/1.73m^2</td><td>≤ 2.2
and a reduction of >50% from baseline</td></tr>
</table>
Reference:
Malaysian Clinical Practice Guidelines Management of Dyslipidaemia 2023</td></tr>
<tr><td>Complement 3 (C3)*</td><td>Plain tube</td><td>3 ml</td><td>1 working day</td><td>0.90-1.80 g/L</td><td></td></tr>
<tr><td>Complement 4 (C4)*</td><td>Plain tube</td><td>3 ml</td><td>1 working day</td><td>0.10-0.40 g/L</td><td></td></tr>
<tr><td>Cortisol (salivary)</td><td>Salivette® oral fluid collection device

*External users to provide their own Salivette® device</td><td>-</td><td>5 working days</td><td>Morning
(6-10 am): 2.1-22.6 nmol/L

Midnight
(11-12 am): <12.0 nmol/L

Reference: Malays J Pathol 2020; 42(3): 433-437</td><td>Weekly: Mondays

Form: PER-PAT 301

Must be stamped and signed by Endocrinologist</td></tr>
<tr><td>Cortisol (serum)*</td><td>Plain tube</td><td>3 ml</td><td>1 working day</td><td>Morning hours
(6-10 am): 133.0-537.0 nmol/L

Afternoon hours
(4-8 pm): 68.2-327.0 nmol/L</td><td></td></tr>
</table>

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

<table>
<tr><th>Test</th><th>Sample Container</th><th>Sample Volume</th><th>LTAT</th><th>Reference Interval</th><th>Remarks</th></tr>
<tr><td>Cortisol (urine)</td><td>24-hr urine container</td><td>At least 500 ml (24-hr)</td><td>1 working day</td><td>24-hour urine:
31.7-282.0 nmol/day</td><td></td></tr>
<tr><td>Creatine Kinase (CK)*</td><td>Plain tube</td><td>3 ml</td><td>6 hours</td><td>Males: 39-308 U/L

Females: 26-192 U/L</td><td></td></tr>
<tr><td>Creatinine Clearance</td><td>Plain tube</td><td>3 ml</td><td>6 hours</td><td>1.2-2.5 mL/sec</td><td></td></tr>
<tr><td>Creatinine (serum)*</td><td>Plain tube</td><td>3 ml</td><td>Urgent:
4 hours

Routine:
6 hours</td><td>Adults
Males: 62-106 µmol/L
Females: 44-80 µmol/L

Children
Neonates (premature): 25-91 µmol/L
Neonates (full term): 21-75 µmol/L
(2-12 months): 15-37 µmol/L
(1- <3 years): 21-36 µmol/L
(3- <5 years): 27-42 µmol/L
(5- <7 years): 28-52 µmol/L
(7- <9 years): 35-53 µmol/L
(9- <11 years): 34-65 µmol/L
(11- <13 years): 46-70 µmol/L
(13- <15 years): 50-77 µmol/L</td><td></td></tr>
<tr><td>Creatinine (urine)*</td><td>Sterile container

24-hr urine container</td><td>5 ml (random)

At least 500 ml (24-hr)</td><td>1 working day</td><td>Random
Males: 3450-22900 umol/L
Females: 2470-19200 umol/L

24-hour
Males: 9000-21000 umol/day
Females: 7000-14000 umol/day</td><td></td></tr>
<tr><td>CSF Biochemistry
• Glucose
• Protein</td><td>Bijou bottle/ Sterile container</td><td>1 ml</td><td>Urgent:
90 minutes

Routine:
4 hours</td><td>Glucose
Adults: 2.22-3.89 mmol/L
Children: 3.33-4.44 mmol/L

Protein
0.150-0.450 g/L</td><td>Send immediately to lab</td></tr>
<tr><td>eGFR</td><td>-</td><td>-</td><td>6 hours</td><td colspan="2">Stages of CKD (KDIGO)
<table>
<tr><th>Stage</th><th>GFR (ml/min/ 1.732 m$^{2)}$</th><th>Terms</th></tr>
<tr><td>G1</td><td>≥90</td><td>Normal or high</td></tr>
<tr><td>G2</td><td>60-89</td><td>Mildly decreased</td></tr>
<tr><td>G3a</td><td>45-59</td><td>Mildly to moderately decreased</td></tr>
<tr><td>G3b</td><td>30-44</td><td>Mildly to moderately decreased</td></tr>
<tr><td>G4</td><td>15-29</td><td>Severely decreased</td></tr>
<tr><td>G5</td><td><15</td><td>Kidney failure</td></tr>
</table>
eGFR must be interpretated with caution in people with extremes of muscle mass or certain illness (e.g. bodybuilders, people who have had amputations, muscle wasting disorders, acute myocardial infarction and acute kidney injury)
Reference: MACB 2024 Recommendation for the Laboratory Reporting of eGFR & Urine Albumin</td></tr>
<tr><td>Estradiol*</td><td>Plain tube</td><td>3 ml</td><td>7 working days</td><td>Healthy men: 41.4-159 pmol/L

Healthy post-menopausal women: <18.4-505 pmol/L

Healthy pregnant women:
1st trimester:
563-11902 pmol/L

2nd trimester:
5729-78098 pmol/L</td><td>Interval between order is 3 months. Please call Pathology MO/Specialist if indicated.

Weekly batch: Tuesdays</td></tr>
</table>

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

Test	Sample Container	Sample Volume	LTAT	Reference Interval	Remarks
				3rd trimester: 31287 - >110100 pmol/L **Healthy women:** Follicular: 114-332 pmol/L Ovulation: 222-1959 pmol/L Luteal: 222-854 pmol/L	
Ferritin*	Plain tube	3 ml	3 working days	**Males:** 30.0-400.0 ng/mL **Females:** 13.0-150.0 ng/mL	
Folate*	Plain tube	3 ml	5 working days	**Males:** 10.2-73.0 nmol/L **Females:** 10.9-84.5 nmol/L **Both**: (4-11 years): 19.5-85.4 nmol/L (12-19 years): 11.3-61.6 nmol/L	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Wed & Fri
Follicle-Stimulating Hormone (FSH)*	Plain tube	3 ml	7 working days	**Men:** 1.5-12.4 U/L **Healthy women** Follicular: 3.5-12.5 U/L Ovulation: 4.7-21.5 U/L Luteal: 1.7-7.7 U/L Post menopause: 25.8-134.8 U/L	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Tuesdays
Gentamicin*	Plain tube	3 ml	**Urgent:** 1 day **Routine:** 3 days	**Random/Peak:** 12.50-20.90 µmol/L **Trough:** 1.00-4.20 µmol/L	*Conversion factors:* *ug/mL x 2.09 = umol/L* *ug/mL x 1.0 = mg/L*
Glucose (fasting)*	Fluoride Oxalate	2 ml	6 hours	**Normal:** <6.10 mmol/L **Prediabetes/IFG:** 6.10-6.90 mmol/L **Diabetes:** ≥7.00 mmol/L	Please order as **GTT** if want to send fasting (FBS) & 2-hour (2HPP) Fasting glucose and random glucose cannot be ordered together **Reference:** Management of Type 2 Diabetes Mellitus (6th edition) 2022
Glucose (random)*	Fluoride Oxalate	2 ml	6 hours	**Normal:** <7.80 mmol/L **Impaired glucose tolerance:** 7.80-11.00 mmol/L **Diabetes:** ≥11.10 mmol/L	Fasting glucose and random glucose cannot be ordered together **Reference:** Management of Type 2 Diabetes Mellitus (6th edition) 2022
Oral Glucose Tolerance Test (OGTT)	Fluoride Oxalate	2 ml	6 hours	<table><tr><th>Category</th><th>0-hour</th><th>2-hour</th></tr><tr><td>Normal</td><td><6.1</td><td><7.8</td></tr><tr><td>IFG</td><td>6.1-6.9</td><td>-</td></tr><tr><td>IGT</td><td>-</td><td>7.8-11.0</td></tr><tr><td>T2DM</td><td>≥7.0</td><td>≥11.1</td></tr></table> 2-hour plasma glucose of ≥11.1 mmol/L confirms the diagnosis of diabetes Patient is considered to have IGT or prediabetes if the 2-hour plasma glucose level is between 7.8-11.0 mmol/L **Reference:** Management of Type 2 Diabetes Mellitus (6th edition) 2022	

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

Test	Sample Container	Sample Volume	LTAT	Reference Interval	Remarks
Haemoglobin A1c (HbA1c)*	EDTA tube (**ONLY** accept 2 ml tube)	2 ml	3 working days	**Normal:** <5.6% (<38 mmol/mol) **Pre diabetes:** 5.7-6.2% (38-44 mmol/mol) **Diabetes:** >6.3% (>45 mmol/mol)	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated Weekdays only
High sensitive Troponin T	Plain tube	3 ml	**Urgent:** 90 minutes **Routine:** 4 hours	3.00-14.00 pg/mL	
Iron*	Plain tube	3 ml	3 working days	**Adults:** 5.83-34.5 µmol/L	
Lactate Dehydrogenase (LDH)*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	**Adults:** 135-225 U/L **Children** (2-15 years): 120-300 U/L **Newborns** (4-20 days): 225-600 U/L	
Luteinizing Hormone (LH)*	Plain tube	3 ml	7 working days	**Men:** 1.7-8.6 U/L **Healthy women:** Follicular: 2.4-12.6 U/L Ovulation: 14.0-95.6 U/L Luteal: 1.0-11.4 U/L Postmenopause: 7.7-58.5 U/L	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Tuesdays
Magnesium (serum)*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	Newborns: 0.62-0.91 mmol/L 5 months-6 years: 0.70-0.95 mmol/L 6-12 years: 0.70-0.86 mmol/L 12-20 years: 0.70-0.91 mmol/L Adults: 0.66-1.07 mmol/L 60-90 years: 0.66-0.99 mmol/L >90 years: 0.70-0.95 mmol/L	
Magnesium (urine)*	Sterile container 24-hr urine container	5 ml (random) At least 500 ml (24-hr)	1 working day	**24-hour**: 3.00-5.00 mmol/day	
Osmolality (serum)*	Plain tube	3 ml	1 working day	270-295 mOsm/kg	
Osmolality (urine)*	Sterile container	5 ml (random)	1 working day	300-900 mOsm/kg	
Paraquat (urine)	Sterile container	5 ml (random)	90 minutes	Negative	
Phenytoin (Dilantin)*	Plain tube	3 ml	**Urgent:** 1 day **Routine:** 3 days	**Therapeutic range:** 39.6-79.2 µmol/L	*Conversion factors:* *ug/mL x 3.96 = umol/L* *ug/mL x 1.0 = mg/L*

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

Test	Sample Container	Sample Volume	LTAT	Reference Interval	Remarks
Phosphate (serum)*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	**Adults** 0.81-1.45 mmol/L **Children (Male)** (1–30 days): 1.25–2.25 mmol/L (1–12 months): 1.15–2.15 mmol/L (1–3 years): 1.00–1.95 mmol/L (4–6 years): 1.05–1.80 mmol/L (7–9 years): 0.95–1.75 mmol/L (10–12 years): 1.05–1.85 mmol/L (13–15 years): 0.95–1.65 mmol/L (16–18 years): 0.85–1.60 mmol/L **Children (Female)** (1–30 days): 1.40–2.50 mmol/L (1–12 months): 1.20–2.10 mmol/L (1–3 years): 1.10–1.95 mmol/L (4–6 years): 1.05–1.80 mmol/L (7–9 years): 1.00–1.80 mmol/L (10–12 years): 1.05–1.70 mmol/L (13–15 years): 0.90–1.55 mmol/L (16–18 years): 0.80–1.55 mmol/L	
Phosphate (urine)*	Sterile container 24-hr urine container	5 ml (random) At least 500 ml (24-hr)	1 working day	**Random:** 13.0-44.0 mmol/L **24-hour**: 13.0-42.0 mmol/day	
Potassium (serum)*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	3.5-5.1 mmol/L	
Potassium (urine)*	Sterile container 24-hr urine container	5 ml (random) At least 500 ml (24-hr)	1 working day	**24-hour:** 25-125 mmol/day	
Procalcitonin (PCT)	Plain tube	3 ml	1 working day	0.020-0.046 ng/mL	Test order by specialist only. Interval between order is 72 hours. Please call Pathology MO/Specialist if indicated.
Progesterone*	Plain tube	3 ml	7 working days	**Healthy men:** 0.442-0.614 nmol/L **Healthy post-menopausal women:** 0.343-0.480 nmol/L **Healthy pregnant women:** 1st trimester: 73.1-82.3 nmol/L 2nd trimester: 144-159 nmol/L 3rd trimester: 328-327 nmol/L **Healthy women:** Follicular: 0.186-0.244 nmol/L Ovulation: 1.57-2.26 nmol/L Luteal: 26.4-31.4 nmol/L	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Tuesdays
Prolactin*	Plain tube	3 ml	7 working days	**Men:** 86-324 mIU/L **Women:** 102-496 mIU/L	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Tuesdays

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

Test	Sample Container	Sample Volume	LTAT	Reference Interval	Remarks
Prostate Specific Antigen (PSA), Total*	Plain tube	3 ml	5 working days	0.006-4.000 ng/mL	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Tues & Thur
Protein, Total (peritoneal fluid)	Sterile container/ Bijou bottle	1 ml	6 hours	Methodology of analysis for body fluid is not validated. Thus, reference range is not available.	
Protein, Total (serum)*	Plain tube	3 ml	6 hours	Adults: 66-87 g/L Newborns: 46-70 g/L 1 week: 44-76 g/L 7 months-1 year: 51-73 g/L 1-2 years: 56-75 g/L >3 years: 60-80 g/L	
Protein, Total (urine)*	Sterile container 24-hr urine container	5 ml (random) At least 500 ml (24-hr)	1 working day	**Random:** 0.040-0.150 g/L **24-hour:** 0.040-0.140 g/day	
Rheumatoid Factor (RF)	Plain tube	3 ml	1 working day	10-14 IU/mL	
Salicylate*	Plain tube	3 ml	**Urgent:** 90 minutes **Routine:** 4 hours	**Toxic range:** >300 mg/L	
Sodium (serum)*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	136-145 mmol/L	
Sodium (urine)*	Sterile container 24-hr urine container	5 ml (random) At least 500 ml (24-hr)	1 working day	**24-hour:** 40-220 mmol/day	
Testosterone*	Plain tube	3 ml	7 working days	**Males:** (20-49 years): 8.64-29.0 nmol/L (≥50 years): 6.68-25.7 nmol/L **Females**: (20-49 years): 0.29-1.67 nmol/L (≥50 years): 0.101-1.42 nmol/L	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Tuesdays
Thyroid Stimulating Hormone (TSH)*	Plain tube	3 ml	**Urgent:** 1 day **Routine:** 3 days	0-6 days: 0.7-15.2 mIU/L 7 days-3 months: 0.72 -11.0 mIU/L 3 months-1 year: 1.02-6.75 mIU/L 1-6 years: 1.09-6.07 mIU/L 6-11 years: 1.13-5.34 mIU/L 11-20 years: 1.01-5.09 mIU/L Adult: 0.27-4.20 mIU/L	For newborn baby, please place order as TSH Cord Blood

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

Test	Sample Container	Sample Volume	LTAT	Reference Interval	Remarks
Thyroid Stimulating Hormone (TSH), neonate*	Plain tube	3 ml	**Urgent:** 1 day **Routine:** 3 days	0.005-20 mIU/L	This test is use for Congenital Hypothyroidism Screening Programme (Cord Blood TSH)
Thyroid Stimulating Hormone (TSH), pregnancy*	Plain tube	3 ml	**Urgent:** 1 day **Routine:** 3 days	1st trimester (1-12 weeks): 0.33-4.59 mIU/L 2nd trimester (13-27 weeks): 0.35-4.10 mIU/L 3rd trimester (28 weeks till birth): 0.21-3.15 mIU/L Manufacturer (adult): 0.27-4.20 mIU/L	The trimester-specific reference interval was established on COBAS PRO Roche. Marked variation between analytical platform should be noted.
Thyroxine, Free (FT4)*	Plain tube	3 ml	1 working day	0-6 days: 11.0-32.0 pmol/L 7 days-3 months: 11.5-28.3 pmol/L 3 months-1 year: 13.3-20.5 pmol/L 1-6 years: 13.4-20.1 pmol/L 6-11 years: 12.9-19.7 pmol/L 11-20 years: 12.9-19.7 pmol/L Adult: 11.9-21.6 pmol/L	
Thyroxine, Free (FT4), neonate*	Plain tube	3 ml	1 working day	>15 pmol/L	
Thyroxine, Free (FT4), pregnancy*	Plain tube	3 ml	1 working day	1st trimester (1-12 weeks): 12.1-19.6 pmol/L 2nd trimester (13-27 weeks): 9.63-17.00 pmol/L 3rd trimester (28 weeks till birth): 8.39-16.00 pmol/L Manufacturer (adult): 11.9-21.6 pmol/L	The trimester-specific reference interval was established on COBAS PRO Roche. Marked variation between analytical platform should be noted.
Transferrin	Plain tube	3 ml	3 working days	2.0-3.6 g/L	
Tri-Iodothyronine, Free (FT3)*	Plain tube	3 ml	1 working day	0-6 days: 1.73-6.30 pmol/L 7 days-3 months: 1.95-6.04 pmol/L 3 months-1 year: 2.15-5.83 pmol/L 1-6 years: 3.45-5.37 pmol/L 6-11 years: 3.53-5.16 pmol/L	Test order by Specialist only

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

Test	Sample Container	Sample Volume	LTAT	Reference Interval	Remarks
				11-20 years: 3.10-4.89 pmol/L Adult: 3.1-6.8 pmol/L	
Triglycerides*	Plain tube	3 ml	6 hours	**Normal:** ≤1.7 mmol/L	Reference: Malaysian Clinical Practice Guidelines Management of Dyslipidaemia 2023
Urea (serum)*	Plain tube	3 ml	**Urgent:** 4 hours **Routine:** 6 hours	2.76-8.07 mmol/L	
Urea (urine)*	Sterile container 24-hr urine container	5 ml (random) At least 500 ml (24-hr)	1 working day	**24-hour:** 428-714 mmol/day	
Uric Acid (serum)*	Plain tube	3 ml	6 hours	**Males:** 202.3-416.5 µmol/L **Females:** 142.8-339.2 µmol/L	
Urine Protein Creatinine Index (UPCI)	Sterile container	5 ml (random)	3 workings day	**Normal to mildly increased:** <0.015 g/mmol **Moderately increased:** 0.015-0.050 g/mmol **Severely increased:** >0.050 g/mmol	*Conversion factor:* *g/mmol x 1000 = mg/mmol*
Valproic Acid*	Plain tube	3 ml	**Urgent:** 1 day **Routine:** 3 days	**Therapeutic:** 346.5-693.0 µmol/L **Toxic:** >693.0 umol/L	*Conversion factors:* *ug/mL x 6.93 = umol/L* *ug/mL x 1.0 = mg/L*
Vancomycin*	Plain tube	3 ml	**Urgent:** 1 day **Routine:** 3 days	**Peak:** 13.80-27.60 umol/L **Trough:** 3.45-6.90 umol/L	*Conversion factors:* *µg/mL x 0.69 = µmol/L* *µg/mL x 1.0 = mg/L*
Vitamin B12*	Plain tube	3 ml	5 working days	145.0-569.0 pmol/L	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. **Weekly batch:** Wed & Fri
Vitreous Humour Biochemistry • Chloride • Glucose • Potassium • Sodium	Bijou bottle/ Plain tube WITHOUT gel	1 ml	6 hours	Methodology of analysis for body fluid is not validated. Thus, reference range is not available.	

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

24-HOUR URINE COLLECTION

i. Empty bladder into toilet after 6:00 am in the morning on the commencement of the test (this specimen is **NOT** to be collected into the 24-hour sterile urine container).
ii. Record on the 24-hour sterile urine container the time and date you passed the urine.
iii. Collect all urine over the next 24 hour directly into the 24-hour sterile urine container provided.
iv. The 24-hour sterile urine container should at all times be stored in the refrigerator.

ORAL GLUCOSE TOLERANCE TEST

Purpose of Test

Used in the diagnosis of diabetes mellitus.

Preparation for the Test

i. You should have an unrestricted diet containing at least 150 g of carbohydrates per day over the three (3) days preceding the test.
ii. You should fast (no food or energy supplying substance) for at least eight hours prior to the test (but no longer than 16 hours). Plain water is permitted during this period and during the test procedure.

Test Procedure

i. All tests are preferably done in the morning because of variations in sugar levels during the course of the day.
ii. On arrival, a fasting blood is collected.
iii. Following this, you will be given a glucose (sugar) drink. You should drink all the liquid over a period of no more than five (5) minutes.
iv. Blood sample is collected after 120 minutes (2 hours) from the start of glucose drink intake.

Note

i. You should not have the test if you are ill or if you are known to have diabetes mellitus.
ii. Smoking is not permitted during the fasting period and throughout the duration of the collection procedure.
iii. Any form of exercise (walking) during the test period should be avoided.

LISTS OF TESTS (REFERRED)

The LTAT stated is based on working days. For referred tests, TAT provided here refers to the referral lab's turnaround time, excluding the time for dispatching of sample to referral lab and the time for the results to be reported or printed in the hospital system.

In general, dispatching to referral lab is done daily, except for Hospital Ampang, Hospital Putrajaya, Hospital Tengku Ampuan Rahimah, and National Institute of Health (NIH) which is done weekly. As for reporting, lab usually takes 1 working day upon receiving the report.

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
5-Hydroxy-Indol-Acetic Acid (5 HIAA), 24-hour urine	24-hour urine container added with 10 ml of 25% HCl **Obtain HCl from the lab before urine collection** For lab: **FREEZE** sample	2 ml from 24-hour urine volume	Biochemistry Unit, SDC IMR	15 working days	IMR Request Form for Biochemical Genetic Tests Please state the **24-hour urine volume collected & pH**
Acid alpha - Glucosidase (POMPE), blood spot	Whatmann 903 Filter Paper Ensure blood completely dried before putting in biohazard bag	3 circles of dried blood spot (~70 ml of blood per circle)	Biochemistry Unit, SDC IMR	10 working days	IMR Request Form for Biochemical Genetic Tests
Adenosine Deaminase (ADA)	Plain tube WITHOUT gel (red cap)	3 ml pleural fluid	Biochemistry Unit, MKAK	4 working days Every Thursday	MKAK Request Form Send to MKAK within 48 hours
Adrenocorticotrophic Hormone (ACTH)	EDTA tube **PUT IN ICE** once blood drawn and send to lab immediately For lab: Separate plasma with **cold centrifuge** & **FREEZE immediately** in secondary tube	3 ml	Special Chemical Pathology Unit, HKL	5 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
*Alagille Syndrome (JAG1 Deletion/ Duplication Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Alagille Syndrome (JAG1 Sequence Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Albumin Creatinine Ratio, urine	Sterile urine container First morning urine (preferred)/ Random urine	5 ml	Core Lab SCACC Lab, HKL	3 working days	PER-PAT 301
Aldosterone Post SST	EDTA tube **DO NOT send in ice** to lab For lab: **Immediately FREEZE** plasma in secondary tube after centrifugation	3 ml	Biochemistry Unit, Hospital Putrajaya	21 working days	PER-PAT 301 **Must be stamped and signed by Specialist**

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
Aldosterone Renin Ratio (ARR)	EDTA tube (**2 TUBES** required) **DO NOT send in ice** to the lab For lab: **Immediately FREEZE** plasma in secondary tubes after centrifugation	3 ml	Biochemistry Unit, Hospital Putrajaya	21 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
Alpha-1-Antitrypsin-Phenotyping	Plain tube	3.5 ml	Chemical Pathology Laboratory, Hospital Ampang	21 working days	PER-PAT 301
Alpha-1-Antitrypsin-Quantitation	Plain tube	3 ml	Chemical Pathology Laboratory, Hospital Ampang	7 working days	PER-PAT 301
Amikacin, Peak	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	5 ml	Chemical Pathology Laboratory, Hospital Selayang	1 working day	TDM Request Form
Amikacin, Random	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	5 ml	Chemical Pathology Laboratory, Hospital Selayang	1 working day	TDM Request Form
Amikacin, Trough	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	5 ml	Chemical Pathology Laboratory, Hospital Selayang	1 working day	TDM Request Form
Amino Acid, CSF	Bijou bottle/ Sterile container **MUST** be sent together with **plasma** amino acid For lab: **FREEZE immediately**	1 ml	IEM Lab, Hospital Tunku Azizah	Urgent: 3 working days Routine: 10 working days	HTA IEM Request Form
Amino Acid, serum/ plasma	Plain tube/ Lithium heparin For lab: Transfer serum/ plasma to secondary tube and **FREEZE immediately**	Paediatric: 0.5 ml Adult: 2 ml	IEM Lab, Hospital Tunku Azizah	Urgent: 3 working days Routine: 10 working days	HTA IEM Request Form
Amino Acid, urine	Sterile urine container For lab: **FREEZE immediately**	5 ml	IEM Lab, Hospital Tunku Azizah	Urgent: 3 working days Routine: 10 working days	HTA IEM Request Form **By consultation only**
*Angelman Syndrome (SNRPN Methylation & Gene Dosage Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Angelman Syndrome (UBE3A Sequence Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services

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Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
*Angelman Syndrome (Uniparental Disomy & Imprinting Defect Analysis)	EDTA tube **Compulsory** to send proband and both biological parental samples	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Anti-Glutamic Acid Decarboxylase (GAD)	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	10 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
Anti-Mullerian Hormone (AMH)	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	10 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
Anti-Thyroglobulin	Plain tube	5 ml	Chemical Pathology Laboratory, Hospital Selayang	30 working days	PER-PAT 301
Anti-Thyroid Peroxidase	Plain tube	5 ml	Chemical Pathology Laboratory, Hospital Selayang	30 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
Anti-Thyroid Stimulating Hormone Receptor	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	10 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
*Barth Syndrome	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Beta-2 Microglobulin	Plain tube	3 ml	Chemical Pathology Laboratory, Hospital Ampang	7 working days	PER-PAT 301
C-Peptide	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	5 working days	PER-PAT 301
Cancer Antigen 15-3 (CA 15-3)	Plain tube	3 ml	Core Lab, HKL	3 working days	PER-PAT 301
*Carbamoyl Phosphate Synthetase 1 (CPS1) Deficiency	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Carnitine Palmitoyltransferase 1 (CPT1) Deficiency	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Carnitine Total and Free, plasma	Lithium heparin/ Plain tube For lab: **FREEZE immediately**	2 ml	Biochemistry Unit, SDC IMR	7 working days	IMR Request Form for Biochemical Genetic Tests
Ceruloplasmin	Plain tube	3 ml	Core Lab, HKL	3 working days	PER-PAT 301
Cholinesterase	Plain tube	5 ml	Chemical Pathology Laboratory, Hospital Selayang	1 working day	PER-PAT 301

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
*Citrin Deficiency (Type II Citrullinemia)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)/ DNA	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Classical Homocystinuria (CBS Sequence Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)/ DNA	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Copper, serum	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	2 ml	Chemical Pathology Laboratory, Hospital Selayang	21 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
Copper, 24-hour urine	24-hour urine container **For lab:** Aliquot in sterile urine container	5 ml from 24-hour urine volume	Chemical Pathology Laboratory, Hospital Selayang	21 working days	PER-PAT 301 Please state the **24-hour urine volume collected** **Must be stamped and signed by Specialist**
Cyclosporin	EDTA tube	2 ml	Drug & Toxicology Lab (IUN), HKL	1 day	TDM Request Form
Cystine & Homocysteine, urine	Sterile universal bottle For lab: **FREEZE immediately**	2 ml	Biochemistry Unit, SDC IMR	10 working days	IMR Request Form for Biochemical Genetic Tests
Dehydroepiandrosterone Sulfate (DHEA-S)	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	5 working days	PER-PAT 301
Delta-Amino Levulinic Acids (Delta-ALA), urine	Sterile universal bottle **Protect sample from light**	2 ml	Biochemistry Unit, SDC IMR	20 working days	IMR Special Proteins Request Form
Diabetes Auto Antibodies Panel (Anti Islet Cells (ICA), Anti-Glutamic Acid Decarboxylase (GAD), Anti-Insulinoma-Associated Antigen 2 (IA2))	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	10 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
Digoxin	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	5 ml	Chemical Pathology Laboratory, Hospital Selayang	1 working day	TDM Request Form
*DNA Extraction and Storage	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	1-2 month(s)	IMR Request Form for Molecular Diagnostics Services
Ethanol	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	4 ml	Core Lab, HKL	1 working day	TDM Request Form
*Ethylmalonic Encephalopathy	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
Everolimus	EDTA tube	2 ml	Drug & Toxicology Lab (IUN), HKL	1 day	TDM Request Form
*Floating-Harbor Syndrome	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Fluconazole, Trough	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	3 ml	Drug & Toxicology Unit, HKL	3 working days Sample analysis on Tues & Thurs	TDM Request Form **Must be stamped and signed ONLY by Infectious Disease (ID) Physician, Anaesthesiologist/ Intensivist, or Haematologist**
Flucytosine, Peak	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	4 ml	Drug & Toxicology Lab, HKL	1 day Sample analysis on Tues & Thurs	Antifungal TDM Request Form **Must be stamped and signed ONLY by Infectious Disease (ID) Physician, Anaesthesiologist/ Intensivist, or Haematologist**
Flucytosine, Trough	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	4 ml	Drug & Toxicology Lab, HKL	1 day Sample analysis on Tues & Thurs	Antifungal TDM Request Form **Must be stamped and signed ONLY by Infectious Disease (ID) Physician, Anaesthesiologist/ Intensivist, or Haematologist**
*FMR1 Disorders (Fragile X Syndrome, FXTAS, FXPOI, FXAND)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Free Light Chain, Kappa & Lambda	Plain tube	3 ml	Chemical Pathology Laboratory, Hospital Ampang	7 working days	PER-PAT 301
Free Prostate-Specific Antigen (PSA)	Plain tube Free PSA is offered if Total PSA = 4-10 ng/mL	3 ml	Core Lab, HKL	3 working days	PER-PAT 301
Fructosamine	Plain tube	3 ml	Chemical Pathology Laboratory, Hospital Ampang	7 working days	PER-PAT 301
*Fructose-1,6 Bisphosphatase Deficiency	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Galactokinase Deficiency	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
Galactosemia Screening, blood spot	Whatmann 903 Filter Paper Ensure blood completely air dried (at least 4 hours) before sealed	3 circles of dried blood spot (~70 ml of blood per circle)	Biochemistry Unit, SDC IMR	7 working days	IMR Request Form for Biochemical Genetic Tests
Gamma Glutamyl transferase (GGT)	Plain tube	5 ml	Chemical Pathology Laboratory, Hospital Selayang	4 hours	PER-PAT 301
Growth Hormone	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	5 working days	PER-PAT 301
Haptoglobin	Plain tube	3 ml	Core Lab, HKL	3 working days	PER-PAT 301
*Hereditary Orotic Aciduria	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Homocysteine Total, plasma	EDTA/ Plain tube For EDTA: **Immediately FREEZE plasma** in secondary tube after centrifugation	2 ml	Biochemistry Unit, SDC IMR	15 working days	IMR Request Form for Biochemical Genetic Tests
Immunoglobulin A (IgA)	Plain tube	3 ml	Chemical Pathology Laboratory, Hospital Ampang	7 working days	PER-PAT 301
Immunoglobulin G (IgG)	Plain tube	3 ml	Chemical Pathology Laboratory, Hospital Ampang	7 working days	PER-PAT 301
Immunoglobulin M (IgM)	Plain tube	3 ml	Chemical Pathology Laboratory, Hospital Ampang	7 working days	PER-PAT 301
IEM screening for acylcarnitine and amino acids	Filter paper (Guthrie paper grade 226, 903) Ensure blood completely air dried (at least 4 hours) before sealed	Dried blood spot	IEM Lab, Hospital Tunku Azizah	Urgent: 3 working days Routine: 10 working days	HTA IEM Request Form
Insulin	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	5 working days	PER-PAT 301
Insulin Autoantibodies (IAA)	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	10 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
Insulin-like Growth Factor 1 (IGF-1)	Plain tube	3.5 ml	Biochemistry Unit, Hospital Putrajaya	21 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
Isavuconazole, Trough	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	4 ml	Drug & Toxicology Lab, HKL	1 day Sample analysis on Tues & Thurs	Antifungal TDM Request Form **Must be stamped and signed ONLY by Infectious Disease (ID) Physician,**

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
					Anaesthesiologist/ Intensivist, or Haematologist
Itraconazole, Trough	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	4 ml	Drug & Toxicology Lab, HKL	1 day Sample analysis on Tues & Thurs	Antifungal TDM Request Form **Must be stamped and signed ONLY by Infectious Disease (ID) Physician, Anaesthesiologist/ Intensivist, or Haematologist**
*Kennedy Disease	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Lead, whole blood	EDTA tube	2 ml	Chemical Pathology Laboratory, Hospital Selayang	21 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
*Leigh Syndrome – Full Panel	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Leopard Syndrome	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Lesch-Nyhan Syndrome	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Lissencephaly	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Lithium	Plain tube	3 ml	Core Lab, HKL	1 working day	TDM Request Form/ PER-PAT 301
*Long-Chain 3-Hydroxyacyl-CoA Dehydrogenase (LCHAD) Deficiency	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*MCT8-Specific Thyroid Hormone Cell Transporter Deficiency	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Metanephrine, 24-hour urine	24-hour urine container added with 10 ml of 25% HCl **Obtain HCl from the lab before collection** **Accepted pH: 2–5**	At least 750 ml of 24-hour urine volume **For lab:** Minimum 3.5 ml aliquot in 2 secondary tubes	Special Endocrine Lab, Hospital Putrajaya	30 working days	PER-PAT 301 Please state the **24-hour urine volume collected** **Must be stamped and signed by Specialist**
Methanol	Sodium Fluoride tube (whole blood and/or urine)	3 ml	Biochemistry Unit, MKAK	14 working days	MKAK Request Form

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
Methotrexate (MXT)	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	4 ml (1 ml acceptable for paeds)	Core Lab, Hospital Tunku Azizah	6 hours	TDM Request Form
*Methylenetetrahydrofolate Reductase Deficiency	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Methylmalonic Aciduria and Homocystinuria	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Mitochondrial Deletion Syndromes - Chronic Progressive External Ophthalmoplegia (CPEO)	EDTA tube/ Urine container/ Sterile container	2-5 ml (1-2 ml acceptable for infants)/ Urine sediment (20 ml of early morning urine)/ Muscle biopsy	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Mitochondrial DNA Deletion Syndromes - Kearns-Sayre Syndrome	EDTA tube/ Sterile container/ Urine container	2-5 ml(1-2 ml acceptable for infants)/ Muscle biopsy/ Urine sediment (20 ml of early morning urine)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Mitochondrial DNA Deletion Syndromes - Pearson Syndrome	EDTA tube/ Urine container/ Sterile container	2-5 ml (1-2 ml acceptable for infants)/ Urine sediment (20 ml of early morning urine)/ Muscle biopsy	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Mitochondrial DNA Depletion Syndrome (ANT1 Sequence Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Mitochondrial DNA Depletion Syndrome (DGUOK Sequence Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Mitochondrial DNA Depletion Syndrome (MPV17 Sequence Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Mitochondrial DNA Depletion Syndrome (POLG Sequence Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Mitochondrial DNA Depletion Syndrome (RRM2B Sequence Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Mucopolysaccharides (GAGs/HRE), urine	Sterile container For lab: **FREEZE immediately**	5 ml (First morning urine)	Biochemistry Unit, SDC IMR	10 working days	IMR Request Form for Biochemical Genetic Tests

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
*Multiple Respiratory Chain Deficiencies	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Mycophenolic Acid (MPA)	EDTA tube For lab: **FREEZE** plasma in secondary tube after centrifugation	3 ml	Drug & Toxicology Lab (IUN), HKL	Within 6 hours after sample analysis (every Friday)	TDM Request Form
*Myoclonic Epilepsy with Ragged-Red Fibers (MERRF) Syndrome	EDTA tube/ Urine container/ Sterile container	2-5 ml (1-2 ml acceptable for infants)/ Urine sediment (20 ml of early morning urine)/ Muscle biopsy	Molecular Diagnostic Unit, SDC IMR	3 months	IMR Request Form for Molecular Diagnostics Services
Myoglobin, urine	Sterile universal container	10 ml **For lab:** Add 200 mg sodium bicarbonate until **pH>8** and **FREEZE**	Chemical Pathology Laboratory, Hospital Ampang	7 working days	PER-PAT 301 For lab: **Please state pH**
*Neuropathy, Ataxia and Retinitis Pigmentosa (NARP) Syndrome	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	3 months	IMR Request Form for Molecular Diagnostics Services
*Non Ketotic Hyperglycinaemia	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Noonan Syndrome	EDTA tube	2-5 ml(1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Organic Acids, urine	Sterile container For lab: **FREEZE immediately**	5 ml	IEM Lab, Hospital Tunku Azizah	Urgent: 5 working days Routine: 15 working days	HTA IEM Request Form
Oligoclonal band, CSF	Plain tube & Bijou bottle **MUST** be sent in pair	3 ml (blood) 2 ml (CSF)	Chemical Pathology Laboratory, Hospital Ampang	21 working days	PER-PAT 301
Orotic Acids, urine	Sterile container For lab: **FREEZE** sample	2 ml	Biochemistry Unit, SDC IMR	7 working days	IMR Request Form for Biochemical Genetic Tests
Parathyroid Hormone (PTH 1-84)	EDTA/ plain tube (Preference given to EDTA as plasma is more stable)	3 ml	Special Chemical Pathology Unit, HKL	5 working days	PER-PAT 301
Phenobarbital	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	5 ml	Chemical Pathology Laboratory, Hospital Selayang	1 working day	TDM Request Form

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
*Phosphomannomutase 2 Deficiency (PMM2)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*POLG-Related Disorders	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Pompe Disease	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Porphyria Profile, urine	Sterile container **Protect sample from light** For lab: **FREEZE** sample	2 ml	Biochemistry Unit, SDC IMR	15 working days	IMR Request Form for Biochemical Genetic Tests
Posaconazole, Trough	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	4 ml	Drug & Toxicology Lab, HKL	1 day Sample analysis on Tues & Thurs	Antifungal TDM Request Form **Must be stamped and signed ONLY by Infectious Disease (ID) Physician, Anaesthesiologist/ Intensivist, or Haematologist**
*Prader-Willi Syndrome	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Primary Dystonia (THAP1)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Progesterone, 17-Hydroxy (17-OHP)	Plain	3.5 ml	Special Endocrine Lab, Hospital Putrajaya	21 working days	PER-PAT 301
Protein Electrophoresis (blood & urine)	Plain tube Universal container (Preferred early morning urine) **For lab:** Aliquot 24-hour urine in urine container	3 ml (blood) **and** 20 ml (urine 24-hour/ random)	Chemical Pathology Laboratory, Hospital Ampang	21 days	PER-PAT 301 **Please state the 24-hour urine volume collected**
*Pseudorheumatoid Dysplasia	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Pterins, CSF	Special tube (with preservative DTE & EDTA) provided by Biochemistry Unit, IMR **Protect sample from light** For lab: **FREEZE** sample	0.5 ml	Biochemistry Unit, SDC IMR	15 working days	IMR Request Form for Biochemical Genetic Tests
*Purine Nucleoside Phosphorylase Deficiency	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
Renin	EDTA tube	3 ml	Special Endocrine Lab, Hospital Putrajaya	21 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
*Retinoblastoma (RB1 Deletion/ Duplication Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Retinoblastoma (RB1 Sequence Analysis Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*SCN1A-Related Seizure Disorders	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
Sex Hormone Binding Globulin	Plain tube	3.5 ml	Special Endocrine Lab, Hospital Putrajaya	7 working days	PER-PAT 301 **Must be stamped and signed by Specialist**
Sirolimus, whole blood	EDTA tube For lab: **DO NOT** spin	2 ml 500 ul (paeds)	Chemical Pathology, Hospital Tunku Azizah	7 days Sample analysis on Wed	TDM Request Form
*Spinal Muscular Atrophy (SMA) (SMN1 Gene Dosage Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Spinal Muscular Atrophy (SMA) (SMN1 Sequence Analysis)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*Spinocerebellar Ataxia - Full Panel (SCA Types 1,2,3,6,7)	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	6 months	IMR Request Form for Molecular Diagnostics Services
Succinylacetone, urine	Sterile container For lab: **FREEZE** sample	2 ml	Biochemistry Unit, SDC IMR	15 working days	IMR Request Form for Biochemical Genetic Tests
Tacrolimus	EDTA tube	2 ml	Drug & Toxicology Lab (IUN), HKL	1 day	TDM Request Form
Theophylline	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	4 ml	Core Lab, HKL	1 day	TDM Request Form
Thyroglobulin	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	10 working days	PER-PAT 301
Total 25-Hydroxy Vitamin D	Plain tube	3 ml	Chemical Pathology, Hospital Tunku Ampuan Rahimah	3 working days	PER-PAT 301 **Must be stamped and signed by Specialist**

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
Voriconazole, Trough	Plain tube WITHOUT gel (red cap) **For lab:** Transfer serum to secondary tube after centrifugation	4 ml	Drug & Toxicology Lab, HKL	1 day Sample analysis on Tues & Thurs	Antifungal TDM Request Form **Must be stamped and signed ONLY by Infectious Disease (ID) Physician, Anaesthesiologist/ Intensivist, or Haematologist**
*Whole Mitochondrial DNA - mtDNA hotspots	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*X-Chromosome Inactivation	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services
*X-linked Adrenoleuko-dystrophy	EDTA tube	2-5 ml (1-2 ml acceptable for infants)	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular Diagnostics Services

LIST OF REQUEST FORMS

Forms	Code	Description
Antifungal Therapeutic Drug Monitoring (TDM) Request Form	v2_June 2025	KKM
Borang Permohonan Ujian Makmal (Spesimen Klinikal)	MKAK-BPU-U01/Rev2018	MKAK
General PER-PAT Form	PER-PAT 301	For other tests
IEM Request Form	HTA/PAT/GEN/PK-01-03	HTA
Request Form for Biochemical Genetic Tests	IMR/SDC/BC/FORM-RQ_Version 7.0	IMR
Request Form for Molecular Diagnostics Services	IMR/SDC/UMD/REQUEST FORM	IMR
Special Protein Unit Request Form	IMR.SDC.UPK.REQUEST FORM	IMR
Therapeutic Drug Monitoring (TDM) Request Form	v1 Year 2022	KKM

All request forms can be downloaded via the hyperlinks or from Public Folder > Borang-Borang > Borang Pathology > Borang Unit Patologi Kimia

** Require consultation with Clinical Geneticist/Neurologist AND clinical evidence which is suggestive of the respective disease. Form must be stamped and signed by Specialist.*

TECHNIQUES FOR BLOOD SPOT COLLECTION

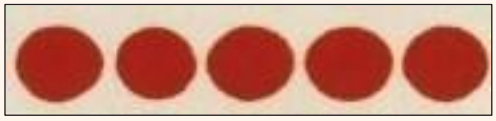
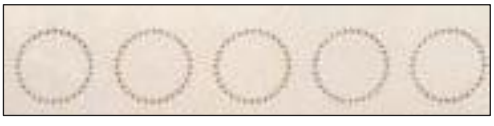
A. Blood obtained from the newborn's heel

1. Clean the designated spot for the prick at the heel of the newborn with an antiseptic. Dry the heel with a sterile swab.
2. Puncture the infant's heel with a sterile lancet. The tip of the lancet must be smaller than 2 mm.
3. Wipe off the first drop of blood with a sterile swab.
4. Touch the next big drop of blood with the filter paper. Wait until the blood has soaked through the paper and completely filled the designated circle.
5. Do not apply any drops of blood on top of the existing blood or on both sides of the filter paper, as this would change the volume of the blood collection per blood spot. Apply blood to only one side of the filter paper
6. Fill each of the remaining circles on the filter paper with blood.
7. Dry the blood spots for 4 hours on a dry, horizontal and non-absorbent surface at ambient temperature.
8. Dried blood spot specimens should be packed and shipped accordingly.

B. Blood obtained from venous collection

1. As soon as the sample collected, the needle should be discarded and the blood should be applied to the preprinted circles through the syringe hub.
   Note: Blood should not be collected from an arm into which intravenous (IV) fluid is being administered
2. Allow a drop of blood to touch the center of a single preprinted circle on the filter paper.
3. Allow a sufficient quantity of blood to soak through and completely fill one preprinted circle.
4. Apply blood to only one side of the filter paper and allow absorbing into the filter paper. If after blood application, the preprinted circle is not completely filled with blood, do not apply more blood to that circle, instead continue on to the next preprinted circle.
   Note: Do not repeatedly dab around the circle
5. Dry the blood spots for 4 hours on a dry, horizontal and non-absorbent surface at ambient temperature.
6. Dried blood spot specimens should be packed and shipped accordingly.

Guideline on simple spot check: satisfactory and unsatisfactory specimens for testing

VALID SPECIMEN	REMARKS
	• Allow a sufficient quantity of blood to soak through to completely fill the pre-printed circle on the filter paper. • Fill all required circles with blood. • Do not layer successive drops of blood or apply blood more than once in the same collection circle. • Avoid touching or smearing spots.
INVALID SPECIMEN	**POSSIBLE CAUSES**
1. Specimen quantity insufficient for testing 	• Removing filter paper before blood has completely filled circle or before blood has soaked through to second side. • Applying blood to filter paper with a capillary tube. • Touching filter paper before or after blood specimen collection with gloved or ungloved hands, hand lotion, etc. • Allowing filter paper to come in contact with gloved or ungloved hands or substances such as hand lotion or powder, either before or after blood specimen collection.
2. Specimen appears scratched or abraded 	• Applying blood with a capillary tube or other device.
3. Specimen not dry before mailing 	• Mailing specimen before drying for a minimum of four hours.
4. Specimen appears supersaturated 	• Applying excess blood to filter paper, usually with a device. • Applying blood to both sides of filter paper.
5. Specimen appears diluted, discolored or contaminated 	• Squeezing or "milking" of area surrounding the puncture site. Allowing filter paper to come in contact with gloved or ungloved hands or substances such as alcohol, formula, antiseptic solutions, water, hand lotion or powder, etc., either before or after blood specimen collection. • Exposing blood spots to direct heat.
6. Specimen exhibits serum rings 	• Not wiping alcohol from puncture site before making skin puncture. • Allowing filter paper to come in contact with alcohol, hand lotion, etc. • Squeezing area surrounding puncture site excessively. • Drying specimen improperly. • Applying blood to filter paper with a capillary tube.
7. Specimen appears clotted or layered 	• Touching the same circle on filter paper to blood drop several times. • Filling circle on both sides of filter paper.
8. No blood 	• Failure to obtain blood specimen.

Source: Hospital Tunku Azizah Pathology Services Handbook

HAEMATOLOGY

INTRODUCTION

The unit provides basic and specialised haematology testing. The tests offered in-house are stated in List of Tests (In-House) and the tests referred are stated in List of Tests (Referred). All analytes are monitored by both internal and external quality assurance programs to ensure reliability.

Reports issued to clinicians are reviewed by the haematologists, medical officers, clinical biochemist and medical laboratory technologists. Clinical interpretation is provided by the haematologists or medical officers where appropriate.

PRE-EXAMINATION VARIABLES

The table below shows common factors that are known to interfere with haematology testing.

Factors	Precautions
Clotted samples	• Clotted samples affect all haematology tests • It is recommended to follow guideline in collection tube section
Inappropriate sample – anticoagulant ratio	• Incorrect blood volume (underfilling and overfilling) affects ESR and coagulation test result i.e. PT, APTT
Haemolysis	• Haemolysis affects most of haematology tests • Allow alcohol to dry completely when it is used for skin sterilisation prior to venepuncture • Never inject a syringe needle into the vacutainer to empty the syringe • Samples should be mixed thoroughly but gently immediately after collection. Vigorous shaking causes red cells to rupture • Avoid extremes of temperature. Never place a blood tube directly on ice as this may cause haemolysis
Contamination	• Avoid taking blood from the arm where an IV infusion has been set up. It can cause a dilution effect of most analytes • Avoid decanting blood from one tube to another even if the tubes contain the same anticoagulant. Follow the recommended order of draw to avoid contamination e.g. blood requiring K^+EDTA preservative must be taken after samples for coagulation tests to avoid the possibility of falsely prolonged PT/ APTT or low fibrinogen results
Icterus and lipemic	Affects coagulation test and FBC test (haemoglobin, MCH, MCHC)
Delay in transit of specimens (>4 hours)	Delays in transit affects coagulation testing and causes platelet, RBC and WBC cell degradation
Haematocrit level >55%	Improper ratio of blood to anticoagulant causes falsely prolonged PT and APTT result and need sodium citrate volume adjustment. Please contact lab for further information
Improper specimen storage/ transport	Specimens not stored or transported according to recommended temperature may cause aberrant results. e.g. CD4/CD8 enumeration should be stored and transported at ambient temperature
Drugs	It is not possible to list all the drugs that may cause interference in analysis. Advice can be obtained from the clinical laboratory staff if required

MEASUREMENT UNCERTAINTY

Haematology tests are subjected to a degree of uncertainty in their measurements. This may be due to a variety of factors including:

a. Biological variation within individual
b. Analytical measurement imprecision
c. Pre-examination factors

Please contact the haematology unit if you wish to know or discuss the uncertainty values for the analytes measured in the laboratory.

LIST OF TESTS (IN-HOUSE)

Test	Sample Container	Volume	Reference Interval	TAT	Remarks
Activated Partial Thrombin Time (APTT)*	3.2% sodium citrate	**Paeds:** 1.8 ml **Adult:** 2.7 ml	20.3 - 29.9 secs	**Urgent:** 90 minutes **Routine:** 4 hours	Send immediately after collection
Bone Marrow Aspiration*	Slide smear		-	**Urgent:** 3 days **Routine:** 7 working days	By appointment
Bone Marrow Trephine Biopsy*	Sterile urine container with 10% formalin	Minimum 1.5 cm		30 days	By appointment
CD4/CD8 Enumeration*	EDTA	2 ml	**CD4+ cells:** 24-48% 358-1279 cells/µL **CD8+ cells:** 15-38% 268-925 cells/µL **CD3+ cells:** 56-81% 831-2240 cells/µL	5 days	**Mon- Thurs:** 8am – 5pm **Fri & Eve of PH:** External: 11 am Internal: 12 pm 1. Send within 12 hours from blood collection 2. Keep and send samples at ambient temperature
D-Dimer*	3.2% sodium citrate	**Paeds:** 1.8 ml **Adult:** 2.7 ml	<500 ng/ml	90 minutes	External: Freeze the plasma if sample cannot be analysed within 4 hours of collection
Erythrocyte Sedimentation Rate (ESR)*	ESR tube (sodium citrate 3.8%)	1.3 ml	**Men (mm/hr)** 0 - 50 years: ≤10 51-60 years: ≤12 61-70 years: ≤14 >70 years: ≤30 **Women (mm/hr**) 0- 50 years: ≤12 51-60 years: ≤19 61-70 years: ≤20 >70 years: ≤35	3 hours	Reference: Dacie & Lewis 12th Edition
Fibrinogen*	3.2% sodium citrate	**Paeds:** 1.8 ml **Adult:** 2.7 ml	200.1–442.6 mg/dL	90 minutes	External: Freeze the plasma if sample cannot be analysed within 4 hours of collection
Full Blood Count*	EDTA	**Paeds:** 0.5 ml **Adult:** 2 ml	Refer table: Full Blood Count Reference Interval	**Urgent:** 45 minutes **Routine:** 4 hours	
Full Blood Count*	Sodium citrate	**Paeds:** 0.5 ml **Adult:** 2 ml		**Urgent:** 45 minutes **Routine:** 4 hours	Only platelet value will be released
Full Blood Picture*	EDTA	**Paeds:** 0.5 ml **Adult:** 2 ml		**Urgent:** 1 day **Routine:** 7 days	Please call MO for urgent FBP MO code is required after office hour

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

Test	Sample Container	Volume	Reference Interval	TAT	Remarks
G6PD Quantitative Assay	EDTA	**Paeds:** 0.5 ml **Adult:** 2 ml	Refer table: National Haematology Committee (Red Cell Enzyme & Membranopathy)	30 days	By appointment (ext: 2116/2117) Send to HSgB lab Monday-Tuesday only. Do not send on PH and eve of PH Provide detailed patient's history with previous G6PD screening result **NOTE:** Do not send during haemolytic crisis Send 3 months post transfusion Recommended to send specimen after 6 months of age **Request form:** PER–PAT 301
G6PD Screening (Peripheral/ cord blood)*	EDTA	2 ml		1 day	Batch test performed twice daily (8 am & 3 pm) 3 months post transfusion Do not send during haemolytic crisis
Haemoglobin (Hb) Analysis	EDTA Send immediately at room temperature	**Paeds:** 0.5 ml **Adult:** 2 ml	Refer table: Hb Analysis Reference Interval National Haematology Workshop Langkawi, 2015 Tosoh Bioscience	Diagnostic: 4 weeks Form 4 screening: 6 weeks	Please refer to: Thalassemia/ Haemoglobinopathy Screening 3 months post transfusion Please exclude IDA before sending Hb analysis performed in Hospital Tuanku Ampuan Rahimah, result reporting done in house For family screening, details of index case must be clearly stated **Request form:** PER-PAT 301
Kleihauer test	EDTA	**Paeds:** 0.5 ml **Adult:** 2 ml		3 days	By appointment Please provide cord blood sample as control
Mixing test*	3.2% sodium citrate	2.7 ml (2 tubes)		3 days	By appointment
Prothrombin Time (PT)*	3.2% sodium citrate	**Paeds:** 1.8 ml **Adult:** 2.7 ml	9.5 – 11.1 sec	**Urgent:** 90 minutes **Routine:** 4 hours	Send immediately after collection
Reticulocyte count*	EDTA	**Paeds:** 0.5 ml **Adult:** 2 ml	0.5-2.5%	4 hours	Reference: Dacie & Lewis 12th Edition

Note:

- All tests are run daily, unless otherwise specified.
- Reference intervals are set according to the methodology and equipment used, unless otherwise specified. Any changes made will be notified.

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

BONE MARROW ASPIRATION AND TREPHINE BIOPSY: RELATED INVESTIGATIONS

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Special Requirement/ Forms
Bone Marrow Aspiration	Bone marrow aspiration	-	Slide smear (by HSgB lab)	In-house	By appointment (To call Hematopathologist HSgB) Send to HSgB lab Mon-Thur only. Do not send on PH and eve of PH **Request form:** PER-PAT 301
Bone Marrow Trephine Biopsy	Bone marrow biopsy	Minimum 1.5 cm	Sterile urine container with 10% formalin	Hospital Selayang (but in-house reporting)	By appointment (To call Hematopathologist HSgB) Send to HSgB lab Mon-Thur only. Do not send on PH and eve of PH **Request form:** PER-PAT 301
Chromosome Analysis for Leukaemia/ Cytogenetic	Bone marrow	1 tube x 4 ml	Sodium heparin	Clinical Haematology Lab, Hospital Ampang	**Request form:** Hospital Ampang Special Haematology Requisition Form
Immunophenotyping (IPT) Leukaemia/ Lymphoma	Bone marrow	2 tubes x 2 ml	EDTA	Haematology Unit, HTA KL (ext. 2169)	**Request form:** PER-PAT 301
Molecular Analysis for Leukaemia	Bone marrow	1 tube x 2 ml	EDTA	IMR	**Request form:** IMR Molecular Analysis for Haemato-Onco Request Form

FULL BLOOD COUNT REFERENCE INTERVAL

Test	Reference Interval		Interference	Reference
Haemoglobin (g/dL)	Males	13.0-17.0	• Haemolysed specimens • Severely icteric plasma causes increased haemoglobin • Very high WBC count, severe lipemia, heparin, certain unusual RBC abnormalities that resist lysing, or anything that increases the turbidity of the sample such as elevated levels of triglycerides	Dacie & Lewis 12th Edition
	Females	12.0-15.0		
	0-2 Days	14.0-22.0		
	3-6 Days	15.0-21.0		
	7-13 Days	13.5-21.5		
	14-29 Days	12.5-20.5		
	1-2 Months	11.5-16.5		
	2-3 Months	9.4-13.0		
	3-12 Months	11.1-14.1		
	1-2 Years	11.1-14.1		
	2-6 Years	11.0-14.0		
	6-12 Years	11.5-15.5		
RBC (10^12/L)	Males	4.5-5.5	• Haemolysed specimens • Very high WBC count, high concentration of very large platelets, agglutinated RBCs, RBCs smaller than 36 fL, specimens containing fibrin, cell fragments, or other debris such as paediatric and oncology specimens	Dacie & Lewis 12th Edition
	Females	3.8-4.8		
	0-2 Days	5.0-7.0		
	3-6 Days	4.0-6.6		
	7-13 Days	3.9-6.3		
	14-29 Days	3.6-6.2		
	1-2 Months	3.0-5.4		
	2-3 Months	3.1-4.3		
	3-12 Months	4.1-5.3		
	1-2 Years	3.9-5.1		
	2-6 Years	4.0-5.2		
	6-12 Years	4.0-5.2		
Haematocrit (%)	Males	40.0-50.0		Dacie & Lewis 12th Edition
	Females	36.0-46.0		
	0-2 Days	45.0-75.0		
	3-6 Days	45.0-67.0		
	7-13 Days	42.0-66.0		
	14-29 Days	31.0-71.0		
	1-2 Months	33.0-53.0		
	2-3 Months	28.0-42.0		
	3-12 Months	30.0-40.0		
	1-2 Years	30.0-38.0		
	2-6 Years	34.0-40.0		
	6-12 Years	35.0-45.0		
MCV (fL)	Adult	83.0-101.0	• Abnormal BUN, glucose, or sodium levels could affect the MCV • Lipemic specimens • Very high WBC count, high concentration of very large platelets, agglutinated RBCs, RBC fragments that fall below the 36-fL threshold, or rigid RBCs	Dacie & Lewis 12th Edition
	0-2 Days	100.0-120.0		
	3-6 Days	92.0-118.0		
	7-13 Days	88.0-126.0		
	14-29 Days	86.0-124.0		
	1-2 Months	92.0-116.0		
	2-3 Months	87.0-103.0		
	3-12 Months	68.0-84.0		
	1-2 Years	72.0-84.0		
	2-6 Years	75.0-87.0		
	6-12 Years	77.0-95.0		
MCH (pg)	Adult	27.0-32.0		Dacie & Lewis 12th Edition
	0-2 Days	31.0-37.0		
	3-6 Days			
	7-13 Days			

Test	Reference Interval		Interference	Reference
	14-29 Days			
	1-2 Months	30.0-36.0		
	2-3 Months	27.0-33.0		
	3-12 Months	24.0-30.0		
	1-2 Years	25.0-29.0		
	2-6 Years	24.0-30.0		
	6-12 Years	25.0-33.0		
MCHC (g/dL)	Adult	31.5-34.5		
	0-2 Days	30.0-36.0		
	3-6 Days	29.0-37.0		
	7-13 Days	28.0-38.0		
	14-29 Days			
	1-2 Months	29.0-37.0		
	2-3 Months	28.5-35.5		
	3-12 Months	30.0-36.0		
	1-2 Years	32.0-36.0		
	2-6 Years	31.0-37.0		
	6-12 Years			
RDW-CV (%)	Adult	11.6-14.0	• Very high WBC count, high concentration of very largeor clumped platelets as in blood anticoagulated with oxalate or heparin, RBCs below the 36-fL threshold, two distinct populations of RBCs, RBC agglutinates, or rigid RBCs	Dacie & Lewis 12th Edition
Platelets (10^9/L)	Adult	150-410	• Haemolysed specimens • Very small red blood cells near the upper threshold, cell fragments, clumped platelets as with oxalate or heparin platelet fragments, or cellular debris near the lower platelet threshold	Dacie & Lewis 12th Edition
	0-2 Days	100-450		
	3-6 Days	210-500		
	7-13 Days	160-500		
	14-29 Days	170-500		
	1-2 Months	200-500		
	2-3 Months	210-650		
	3-12 Months	200-550		
	1-2 Years	200-550		
	2-6 Years	200-490		
	6-12 Years	170-450		
WBC (10^9/L)	Adult	4.0-10.0	• Certain unusual RBC abnormalities that resist lysing, nucleated RBCs, fragmented • WBCs, agglutinated WBCs, any unlysed particles greater than 35 fL, very large or aggregated platelets as when anticoagulated with oxalate or heparin, specimens containing fibrin, cell fragments, or other debris such as paediatric and oncology specimens	Dacie & Lewis 12th Edition
	0-2 Days	10.0-26.0		
	3-6 Days	7.0-23.0		
	7-13 Days	6.0-22.0		
	14-29 Days			
	1-2 Months	5.0-19.0		
	2-3 Months	5.0-15.0		
	3-12 Months	6.0-18.0		
	1-2 Years	6.0-16.0		
	2-6 Years	5.0-15.0		
	6-12Years	5.0-13.0		
Neutrophils (%)	Adult	40.0-80.0		Dacie & Lewis 12th Edition
Neutrophils (10^9/L)	Adult	2.0-7.0	• High triglycerides affecting lysing	
	0-2 Days	4.0-14.0		
	3-6 Days	3.0-5.0		
	7-13 Days	3.0-6.0		
	14-29 Days	3.0-7.0		
	1-2 Months	3.0-9.0		
	2-3 Months	1.0-5.0		

Test	Reference Interval		Interference	Reference
	3-12 Months	1.0-6.0		
	1-2 Years	1.0-7.0		
	2-6 Years	1.5-8.0		
	6-12 Years	2.0-8.0		
Lymphocytes (%)	Adult	20.0-40.0		Dacie & Lewis 12th Edition
Lymphocytes (10^9/L)	Adult	1.0-3.0		
	0-2 Days	3.0-8.0		
	3-6 Days	2.0-8.0		
	7-13 Days	3.0-9.0		
	14-29 Days			
	1-2 Months	3.0-16.0		
	2-3 Months	4.0-10.0		
	3-12 Months	4.0-12.0		
	1-2 Years	3.5-11.0		
	2-6 Years	6.0-9.0		
	6-12 Years	1.0-5.0		
Monocytes (%)	Adult	2.0-10.0		Dacie & Lewis 12th Edition
Monocytes (10^9/L)	Adult	0.2-1.0		
	0-2 Days	0.5-2.0		
	3-6 Days	0.5-1.0		
	7-13 Days	0.1-1.7		
	14-29 Days			
	1-2 Months	0.3-1.0		
	2-3 Months	0.4-1.2		
	3-12 Months	0.2-1.2		
	1-2 Years	0.2-1.0		
	2-6 Years			
	6-12 Years			
Eosinophils (%)	Adult	1.0-6.0		Dacie & Lewis 12th Edition
Eosinophils (10^9/L)	Adult	0.02-0.5		
	0-2 Days	0.1-1.0		
	3-6 Days	0.1-2.0		
	7-13 Days	0.1-0.8		
	14-29 Days	0.1-0.9		
	1-2 Months	0.2-1.0		
	2-3 Months	0.1-1.0		
	3-12 Months			
	1-2 Years			
	2-6 Years			
	6-12 Years			
Basophils (%)	Adult	1.0-2.0		Dacie & Lewis 12th Edition
Basophils (10^9/L)	Adult	0.02-0.1		
NRBC (10^9/L)	Adult			
NRBC	Adult			
Reticulocyte (%)	Adult	0.5-2.5		Dacie & Lewis 12th Edition
Reticulocyte (10^9/L)	Adult	50-100		
	0-2 Days	120-400		
	3-6 Days	50-350		
	7-13 Days	50-100		
	14-29 Days			
	1-2 Months	20-60		
	2-3 Months	30-50		

Test	Reference Interval		Interference	Reference
	3-12 Months	40-100		
	1-2 Years	30-100		
	2-6 Years	30-100		
	6-12 Years	30-100		

GUIDE FOR G6PD SCREENING AND ASSAY IN PAEDIATRICS

G6PD Screening Result	Action
Deficient / Intermediate	To send G6PD Assay

REFERENCE INTERVAL G6PD ASSAY QUANTITATIVE (Ug/Hb)

Classification	Neonate (<1 month old)	Paeds (1 month old-12 years old)	Adult (>12 years old)
Severe Deficiency (<10%)	<1.11	<1.37	<1.09
Moderate Deficiency (10% - 60%)	1.11 - 6.68	1.37 - 8.21	1.09 -6.52
Normal (>60%)	>6.68	>8.21	>6.52
Median of normal (100%)	11.14	13.69	10.86

HAEMOGLOBIN ANALYSIS REFERENCE INTERVAL

HPLC Method	
HbA2 (%)	2.0 – 3.5
HbF (%)	< 2.0
CE Method	
HbA2 (%)	2.2 – 3.2
HbF (%)	< 1.0

THALASSEMIA/ HAEMOGLOBINOPATHY SCREENING

Hb Analysis Indications

i. Family screening: First degree family member/ spouse known to have Thalassemia/ Haemoglobinopathy
ii. Hypochromic microcytic RBC with normal Hb level
iii. Hypochromic microcytic anaemia with normal iron profile

Unsuitable for Hb analysis

i. Iron deficiency anaemia. To optimise iron first as IDA may lead to a false negative result. Suggest to repeat FBC after 3 months of iron treatment. To proceed with Hb analysis if RBC remains hypochromic microcytic despite normal iron profile
ii. Post transfusion sample. To send for Hb analysis after 3 months post transfusion
iii. Paediatric case: Suggest to send Hb analysis after 1 year old unless severe/ symptomatic anaemia requiring transfusion (pre transfusion sample)
iv. Duplicate order. Print and attach previous report if to repeat

LIST OF TESTS (REFERRED)

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	TAT	Special Requirement/ Forms
ADAMTS 13	Blood	1 tube x 2.7 ml Please collect until the indicated mark	3.2% sodium citrate	Clinical Haematology Lab, Hospital Ampang	6 weeks	By appointment Send immediately to lab (within 4 hours collection) **Request form:** Hospital Ampang Special Haematology Requisition Form
Anti-thrombin Protein C Protein S	Blood	**Adults:** 3 tubes **Paeds:** 2 tubes **For paediatric samples please use adult size tubes*	3.2% sodium citrate	Haematology Unit, HTA, KL (ext. 2169)	6 weeks	Send immediately to lab (within 4 hours collection) **Request form:** PER-PAT 301
Anti-Xa	Blood	1 tube x 2.7 ml Please collect until the indicated mark	3.2% sodium citrate	Clinical Haematology Lab, Hospital Ampang	14 days	Send immediately to lab (within 4 hours collection) **Request form:** Hospital Ampang Special Haematology Requisition Form
Chromosome Analysis for Leukaemia/ Cytogenetic	Blood Bone marrow	2 tubes x 4 ml 1 tube x 4 ml	Sodium heparin	Clinical Haematology Lab, Hospital Ampang	6 weeks	By appointment with Haematologist, Hospital Ampang Fresh specimen Send to HSgB lab Mon-Wed only. Samples must reach before 9 am. Do not send on PH and eve of PH **Request form:** Hospital Ampang Special Haematology Requisition Form
Chromosome Analysis (for genetic disease)	Blood	1 tube x 4 ml	Lithium heparin	Cytogenetics Unit, HTA, KL (ext. 2711)	6 months	By appointment Fresh specimen Send to HSgB lab Mon-Wed only. Samples must reach before 9 am. Do not send on PH and eve of PH **Request form:** Cytogenetics Request Form
Cytogenetic FISH	Blood Bone marrow	2 tubes x 4 ml 1 tube x 4 ml	Sodium heparin	Clinical Haematology Lab, Hospital Ampang	30 days (case to case basis)	By appointment with Haematologist, Hospital Ampang Fresh specimen Send to HSgB lab Mon-Wed only. Samples must reach before 9 am. Do not send on PH and eve of PH **Request form:** Hospital Ampang Special Haematology Requisition Form
DNA Analysis Alpha Thalassemia	Blood	**Adults:** 1 tube x 2 ml **Paeds:** 1 microtainer x 0.5 ml	EDTA	Haematology Unit, HKL (ext. 5746/ 5748)	4 months	Must attach: Hb analysis Report Latest FBC result (<3 months) Detailed history of index case for family screening

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	TAT	Special Requirement/ Forms
						Request form: DNA analysis of Thalassemia Syndromes & Hemoglobinopathy' s Request Form
DNA Analysis Beta Thalassemia	Blood	**Adults:** 1 tube x 2 ml **Paeds:** 1 microtainer x 0.5 ml	EDTA	Haematology Unit, HKL (ext. 5746/ 5748)	4 months	Must attach: Hb analysis Report Latest FBC result (<3 months) Patient <12 years must send: Parent's Hb Analysis report Parent's FBC result (3 months) **Request form:** DNA analysis of Thalassemia Syndromes & Hemoglobinopathy' s Request Form
Erythropoietin (EPO)	Blood	1 tube x 5 ml	Plain tube	Clinical Haematology Lab, Hospital Ampang	3 months	By appointment Fresh sample **Request form:** Hospital Ampang Special Haematology Requisition Form
Factor Assay (Factor VIII, IX)	Blood	2 tubes x 2.7 ml	3.2% sodium citrate	Hospital Tengku Ampuan Rahimah (HTAR)	14 days	Send immediately to lab (within 4 hours collection) **Request form:** PER-PAT 301
Factor Inhibitor (Factor VIII, IX)	Blood	2 tubes x 2.7 ml	3.2% sodium citrate	Hospital Tengku Ampuan Rahimah (HTAR)	14 days	Send immediately to lab (within 4 hours collection) **Request form:** PER-PAT 301
Heparin induced Thrombocytopenia (HITT)/ Vaccine Induced Thrombocytopenia (VITT)	Blood	2 tubes x 5 ml	Plain tube	Clinical Haematology Lab, Hospital Ampang	2 months	By appointment Fresh sample **Request form:** Hospital Ampang Special Haematology Requisition Form
Immunophenotyping (IPT) Leukaemia/ Lymphoma	Blood/ Bone marrow	2 ml x 2 tubes	EDTA	Haematology Unit, HTA, KL (ext. 2169)	30 days	Fresh sample Send to HSgB lab Mon-Wed only. Samples must reach before 9 am. Do not send on PH and eve of PH **Request form:** PER-PAT 301
Lupus anticoagulant (LA)	Blood	**Adults:** 3 tubes x 2.7 ml **Paeds:** 2 tubes x 2.7 ml	3.2% sodium citrate	Haematology Unit, Hospital Selayang	6 weeks	Send immediately to lab (within 4 hours collection) Monday-Friday only External: Freeze the plasma if sample cannot be analysed within 4 hours of collection For test indication, please refer to Guidance on Patient Selection for Lupus Anticoagulant (LA) Testing **Request form:** PER–PAT 301
Molecular Analysis for	Blood	3 tubes x 2 ml	EDTA	Haematology	30 days	Fresh sample

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	TAT	Special Requirement/ Forms
Leukaemia	Bone marrow	1 tube x 2 ml		Unit, CaRC IMR, NIH		Send to HSgB lab Mon-Wed only. Samples must reach before 9 am. Do not send on PH and eve of PH **Request form:** IMR Molecular Analysis for Haemato-Onco Request Form
Molecular BCR/ABL 1	Blood Bone marrow	3 tubes x 2 ml 1 tube x 2 ml	EDTA	Haematology Unit, CaRC IMR, NIH	30 days	Fresh sample Send to HSgB lab Mon-Wed only. Samples must reach before 9 am. Do not send on PH and eve of PH External: Inform MO Haematology ext. 2117 prior sample collection **Request form:** IMR Molecular Analysis for Haemato-Onco Request Form
Molecular Genetic Test	Specimen requirements are according to cases. Please refer to Request Form for Molecular Diagnostic Services or call IMR (03-2616 2540/ 2590) for details			Unit of Molecular Diagnostics and Protein (UMDP), IMRKL	3 months	All cases must be referred to and endorsed by a Clinical Geneticist before sending specimens **Request form:** IMR Request Form for Molecular Diagnostics Services
Molecular JAK 2	Blood/ Bone marrow	2 tubes x 2 ml	EDTA	Clinical Haematology Lab, Hospital Ampang	8 weeks	Send to HSgB lab Mon-Wed only. Samples must reach before 9 am. Do not send on PH and eve of PH External: Inform MO Haematology ext. 2117 prior sample collection **Request form:** Hospital Ampang Special Haematology Requisition Form
PNH (Paroxysmal Nocturnal Haemoglobinuria)	Blood	2 tubes x 2 ml	EDTA	Haematology Unit, HTA, KL	30 days	Fresh sample Send to HSgB lab Mon-Wed only. Samples must reach before 9 am. Do not send on PH and eve of PH **Request form:** PER-PAT 301
Rare Factor Assay (Factor II, V, VII, X, XII, XIII)	Blood	**> 1 year:** 4 tubes x 2.7 ml **≤ 1 year:** 2 tubes x 2.7 ml	3.2% sodium citrate	Haematology Unit, HTA, KL (ext. 2169	30 days	Send immediately to lab (within 4 hours collection) **Request form:** PER-PAT 301
Von Willebrand Factor (VWF)	Blood	**> 1 year:** 4 tubes x 2.7 ml **≤ 1 year:** 2 tubes x 2.7 ml	3.2% sodium citrate	Haematology Unit, HTA, KL (ext. 2169	30 days	Send immediately to lab (within 4 hours collection) **Request form:** PER-PAT 301

Note:

- All tests require freshly collected samples to be sent to the lab immediately with the exception of DNA Analysis for Alpha and Beta Thalassemia. DNA Analysis specimen may be stored at 2- 8°C prior to sending.
- Appointments should be made with the respective referral labs and the appointment date stated on the request form. If the given date is not within our lab's appointed schedule, kindly inform us prior to sample collection for further arrangement.
- Refer to the request forms for additional sampling guidelines.
- Reference interval for all referred test will follow the ranges specified by the perform site/ location.

GUIDANCE ON PATIENT SELECTION FOR LUPUS ANTICOAGULANT (LA) TESTING

1. LA testing should be performed, together with testing for aCL, and anti-B2GP1, to assess the risk profile, in patients who are likely to have APS:

    - younger patients (<50 years) with unprovoked venous thromboembolism (VTE)
    - VTE at unusual sites
    - younger patients (<50 years) with ischemic stroke, transient ischemic attack or other evidence of brain ischemia
    - arterial thrombosis in other sites in younger patients (<50 years)
    - microvascular thrombosis
    - recurrent VTE unexplained by subtherapeutic anticoagulation, patient nonadherence, or malignancy
    - pregnancy morbidity:
        - fetal loss after 10 weeks
        - recurrent early (first trimester) miscarriages
        - prematurity (<34 weeks' gestation) associated with severe (pre) eclampsia, HELLP syndrome, placental insufficiency (fetal growth restriction), stillbirth
    - Systemic Lupus Erythematosus (SLE): testing for LA is part of the diagnostic criteria and contributes to risk assessment

2. LA testing could be considered in the following situations:

    - immune thrombocytopenia, particularly with presence of arthralgias or arthritis, hair loss, sun sensitivity, mouth ulcers, rash and thromboembolism
    - livedo reticularis, particularly with presence of symptoms of other systemic autoimmune diseases or mild thrombocytopenia
    - younger patients (<50 years) with noncriteria clinical manifestation i.e. those not included in the Sydney criteria, e.g. cognitive dysfunction, valvular heart disease with presence of evidence of other systemic autoimmune diseases
    - patients of younger age (<50 years) following provoked VTE when the provoking environmental factor is disproportionally mild
    - patients with unexplained prolonged aPTT as an incidental finding

GUIDANCE ON PATIENT SELECTION FOR INHERITED (HERITABLE) THROMBOPHILIA TESTING

General Principles

- Inherited (heritable) thrombophilia testing should be performed only when results are expected to influence clinical management. Unexplained arterial thrombosis (stroke or myocardial infarction) with no apparent risk factor and age <50 years old.
- Testing should always be case-by-case and guided by clinical judgment, patient and family history, and potential impact on management.
- Routine screening after a thrombotic event or in asymptomatic individuals is not recommended.
- Timing of testing is critical to ensure reliable interpretation.
- In situations where the clinical utility of testing is not clear, testing is not mandatory.
- Effective communication between clinical and pathology colleagues is essential when the clinical utility of testing is uncertain.

Indications for Testing

a) Recommended / Considered

- Venous thromboembolism (VTE): deep vein thrombosis (LVT) pulmonary embolism (PE), occurring <40 years of age, and either:
  - Spontaneous (Unprovoked)
  - Associated only with weak environmental risk factors e.g. mild obesity, use of OCP
  - At least one first-degree relative. with history of VTE
- Neonates or children with purpura fulminans - urgent testing for Protein C and Protein S deficiency.
- Neonates with multiple unexplained thromboses, (possible catastrophic antiphospholipid syndrome; CAPS) - consider testing for antiphospholipid antibodies and inherited (heritable) thrombophilia.
- Patients with warfarin-induced skin necrosis - urgent testing for Protein C and Protein S deficiency.
- Pregnant women with a family history of antithrombin deficiency or signs of heparin resistance - consider testing for antithrombin deficiency.
- Asymptomatic first-degree relatives of patients with known Protein C, Protein S, or Antithrombin deficiency: selective testing may be considered only if results would influence management (e.g., pregnancy, surgery, or hormonal therapy).

b) Not Recommended

- It is not recommended to routinely perform inherited (heritable) thrombophilia testing after VTE for the purpose of guiding treatment duration or anticoagulant selection.
- Inherited (heritable) thrombophilia testing is not recommended for routine screening of first-degree relatives of individuals with a history of VTE.
- Inherited (heritable) thrombophilia testing is not recommended for thrombosis at unusual sites (e.g. splanchnic or cerebral venous sinuses) as the association is weak and results do not influence management.
- Inherited (heritable) thrombophilia testing is not recommended for arterial thrombosis (e.g. myocardial infarction, cardiac, or peripheral arterial thrombosis) as it is not indicated and does not influence management.
- Inherited (heritable) thrombophilia testing is not recommended for stroke, regardless of age, as results do not alter management. In neonatal and childhood stroke, its role is uncertain and should be considered on a case-to-case basis.
- Testing for inherited (heritable) thrombophilia is **NOT recommended** for pregnancy complications, including recurrent miscarriage, intrauterine foetal death, placental abruption and severe pre-eclampsia, as the association is weak and results do not change management.
- Inherited (heritable) thrombophilia testing is not recommended for routine evaluation of subfertility or recurrent implantation failure in the absence of a personal or strong family history of venous thromboembolism.
- Inherited (heritable) thrombophilia testing is not recommended in patients with retinal vein or artery occlusion, as the association with inherited (heritable) thrombophilia is weak and test results do not influence management.
- Activated Protein C Resistance (APCR), a functional testing for Factor V Leiden is not recommended routinely, as the mutation is extremely low in Southeast Asia and test results do not influence management.

Timing of Testing

- Testing should be deferred for at least 6 weeks after an acute thrombotic event, as levels of Protein C, Protein S, and Antithrombin may be transiently reduced during the acute phase.
- Testing for Protein C, Protein S, and Antithrombin should be performed at least 3 months after completion of anticoagulation for acute thrombosis.
- Anticoagulant therapy can affect results:
  - Warfarin: defer testing for at least 2 weeks after discontinuation
  - DOACs: defer testing for at least 48-72 hours after discontinuation
  - Heparin/ LMWH: defer testing for at least 12-24 hours
- For-non-urgent-neonatal-indications, testing should be delayed until ≥ 6 months of age, when developmental haemostasis allows more reliable interpretation.

Source: Specialised Haemostasis, Haematology Laboratory, Pathology Department, Hospital Tunku Azizah, Kuala Lumpur.

LIST OF REQUEST FORMS

Form	Code	Description
Borang Permohonan Ujian Perkhidmatan Patologi	PER-PAT 301	For other tests
DNA Analysis of Thalassemia Syndromes & Hemoglobinopathy' s Request Form	DNA Ana for Thal Synd & Hbpathy(s) REQform, Haematology Unit, CaRC IMR Date of Issue: 21.11.2022, Version 4.1	DNA Analysis for Thalassemia Syndromes & Haemoglobinopathies
Hospital Ampang Special Haematology Requisition Form	Hem-RQ19 Version 5	Clinical Haematology Lab, Hospital Ampang
IMR Molecular Analysis for Haemato-Onco Request Form	Haemato-oncology request form (Version 3.0)	Molecular analysis for Haemato-Oncology

All request forms can be downloaded via the hyperlinks or from Public Folder > Borang-Borang > Borang Pathology > Borang Haematology

TRANSFUSION MEDICINE

INTRODUCTION

The Transfusion Medicine Unit provides comprehensive laboratory services to support the safe and appropriate use of blood and blood components for patient care. Services include pre-transfusion testing, immunohematology investigations, compatibility testing, blood component selection and issue, transfusion reaction investigations and transfusion consultation.

Tests and services performed in the unit are listed in the List of Tests (In-House). In contrast, tests referred to external laboratories, Seksyen Makmal Rujukan Immunohematologi Kebangsaan (MRIK), Pusat Darah Negara (PDN) are listed in the List of Tests (Referred).

FACTORS AFFECTING TEST RESULTS

Appropriate specimen collection and handling are essential to ensure accurate transfusion testing and the timely provision of blood components. The following factors may affect test results, delay specimen processing and blood component issues, require repeat specimen collection and potentially compromise patient safety.

Factors	Precautions
Haemolysed specimen	May interfere with immunohematology testing and the interpretation of results. A repeat specimen may be required if the specimen is unsuitable for testing.
Clotted specimen	Unsuitable for tests requiring EDTA-anticoagulated blood (e.g. ABO/RhD grouping, antibody screening and compatibility testing). Repeat specimen required.
Insufficient specimen volume	It may be inadequate to perform all the requested tests or additional investigations. A repeat specimen may be requested.
Incorrect specimen tube or anticoagulant	May render the specimen unsuitable for testing. A repeat specimen is required.
Improper sample labelling or patient identification error	The specimen will be rejected in accordance with the laboratory specimen acceptance policy. A correctly identified repeat specimen is required.
Recent blood transfusion	May affect immunohematology results, including red cell phenotyping and antibody investigations. Relevant clinical history should be provided.
Delayed transport or improper storage	May compromise specimen integrity and affect test performance. A repeat specimen may be required.

BLOOD TRANSFUSION PROCEDURES

The decision to transfuse should be based on the patient's clinical condition, with careful consideration of the expected benefits, potential risks and available alternatives to transfusion.

Although blood transfusion is a life-saving therapy, it carries potential risks, including transfusion-transmitted infections, transfusion reactions, and incorrect blood component transfusion, which may result in serious or fatal outcomes.

Appropriate policies and procedures must be followed throughout the transfusion process to ensure patient safety. Whenever possible, non-urgent transfusions should be performed during normal working hours. Blood transfusions outside office hours should be reserved for emergency or clinically indicated situations.

1. Consent for Transfusion

i. Informed consent should be obtained from the patient, parent, or legal guardian before any planned blood transfusion.
ii. The clinician should explain the indication for transfusion, expected benefits, potential risks, and available alternatives. The patient should be allowed to ask questions before making an informed decision.
iii. The discussion between the clinician and the patient should be documented in the patient's medical record. Written informed consent must be obtained before transfusion in accordance with the hospital's consent policy.

iv. If the patient is unable to provide written consent, consent should be obtained from the parent, legal guardian, or an authorised family member, where applicable.
v. In an emergency requiring immediate transfusion and where obtaining written consent is not feasible, the decision to proceed may be made by two fully registered medical practitioners. The reason for proceeding without written consent must be documented in the patient's medical record, and the patient or family member should be informed as soon as practicable after the transfusion.

2. Blood Ordering and Sample Collection

Blood samples for pre-transfusion testing must be collected and labelled immediately at the patient's bedside as a single uninterrupted process. Only one patient shall be attended to at any one time to minimise the risk of patient misidentification. The requesting clinician is responsible for ensuring that:

i. Personal login credentials are used to access the eHIS
ii. The blood request is placed under the correct patient's medical chart
iii. Print the specimen label, collect the blood sample, and label the specimen at the patient's bedside
iv. The blood request form is completed accurately and all relevant clinical information is provided

3. Patient Identification

Accurate patient identification at every stage of the transfusion process is essential to ensure patient safety and minimise the risk of transfusion errors. Before specimen collection, verify the patient's identity by:

i. Asking the patient to state their full name using an open-ended question
ii. Checking the patient's identification wristband
iii. Confirming that the patient's details on the wristband, clinical records and printed specimen label are identical

For unconscious patients, identity must be verified using the information on the patient's identification wristband. If the patient is unconscious and their identity is unknown, the patient may be identified as "Unknown" together with the unique medical record number assigned at the time of admission. This identifier shall be used consistently throughout the transfusion process until the patient's identity has been confirmed and the correct personal details are available.

4. Labelling of Sample

i. Label all blood specimens immediately after collection, in the presence of the patient at the bedside. The person collecting the specimen is responsible for labelling it.
ii. Pre-labelling of specimen tubes is strictly prohibited.
iii. Verify that the patient identifiers on the specimen label match those on the patient's identification wristband.
iv. Never collect or label specimens for more than one patient at the same time.

5. Blood Requesting Form

The prescribing of blood and blood components is the responsibility of the clinician managing the patient. Blood requests must be submitted via the eHIS and accompanied by a completed blood request form, where applicable.

The relevant patient information should include:

i. Patient identifiers (full name, IC/passport number & hospital registration number)
ii. Current working diagnosis
iii. Clinical indication for transfusion
iv. Relevant transfusion history
v. Consultant or attending physician
vi. Blood group, if known
vii. Latest haemoglobin level or other relevant laboratory results, where applicable
viii. Type of blood component or laboratory test requested

The requesting clinician shall ensure that the blood request form is completed accurately and signed. The clinician's name should be clearly printed or stamped to facilitate identification.

6. Receipt of Specimens and Blood Requests

Blood specimens shall be transported to the Blood Bank by one of the following methods:

i. Hand-delivered to the Blood Bank counter
ii. Send via pneumatic tube system (115)

The Transfusion Reaction Investigation specimens must **NOT** be transported via the pneumatic tube system.

Upon receipt, Blood Bank personnel shall verify that the blood request form is complete and that the specimen is correctly labelled and matches the accompanying request before accepting the specimen for testing.

7. Specimen and Blood Request Rejection

i. Specimen rejection shall be carried out in accordance with the laboratory's specimen acceptance and rejection policies.
ii. In **life-threatening emergencies**, the Blood Bank shall promptly communicate with the requesting clinician to resolve any discrepancies that may otherwise result in rejection of the specimen or blood request, where appropriate.
iii. All discussions and agreed resolutions, including those conducted by telephone, shall be fully documented.

8. Pre-Transfusion Testing and Special Requirements

Pre-transfusion testing is performed to ensure the safe selection and provision of compatible blood components for transfusion. A pre-transfusion blood specimen is required to determine the patient's ABO and RhD blood group, detect clinically significant red cell antibodies, and ensure compatibility between the patient and the selected blood component. The type of testing requested depends on the patient's clinical condition, the urgency of transfusion, and the likelihood of requiring a blood transfusion.

Test	Description
Group, Screen and Hold (GSH)	• Performed for patients with a **low** probability of transfusion. • Includes ABO blood grouping, RhD typing, and antibody screening. • The patient's specimen will be retained in the Blood Bank for 48 hours. • If transfusion is required, the request may be converted to GXM.
Group and Crossmatching (GXM)	• Performed for patients with a **high** probability of transfusion. • Includes ABO blood grouping, RhD typing, antibody screening, and compatibility testing (crossmatch). • Crossmatched blood units will be reserved for 48 hours before being released to the normal pool if not collected.
Antibody screening	• If positive, need to proceed with antibody identification
Direct Coomb's Test (DCT)	• Performed when clinically indicated, including investigation of transfusion reactions, haemolytic disease of the foetus and newborn (HDFN), incompatible crossmatch and positive antibody screening (where appropriate). • May also be performed on donor blood units (e.g. Safe O units) when indicated.
Antibody Identification	• Performed whenever the antibody screening test is positive. • In life-threatening emergencies, crossmatch-compatible blood may be issued after a pre-transfusion specimen has been collected for antibody identification, following discussion with the Blood Bank MO or Transfusion Medicine Specialist (TMS). • In non-urgent cases, specimens will be referred to the IH Section, Blood Bank, HSgB and MRIK, PDN for special cases or inconclusive results.
Saline Phase Crossmatch (first-stage emergency crossmatch)	• Performed when red cell transfusion is required urgently but the patient's condition is not immediately life-threatening. • ABO-compatible red blood cell units are preferred over uncrossmatched Group O RhD-positive red blood cell units whenever feasible. • Performed at room temperature, and compatible blood is generally available within 20 minutes, provided no unexpected antibodies or serological discrepancies are detected. • Full compatibility testing will continue after blood has been issued. Any incompatibility identified will be communicated immediately to the requesting clinician.

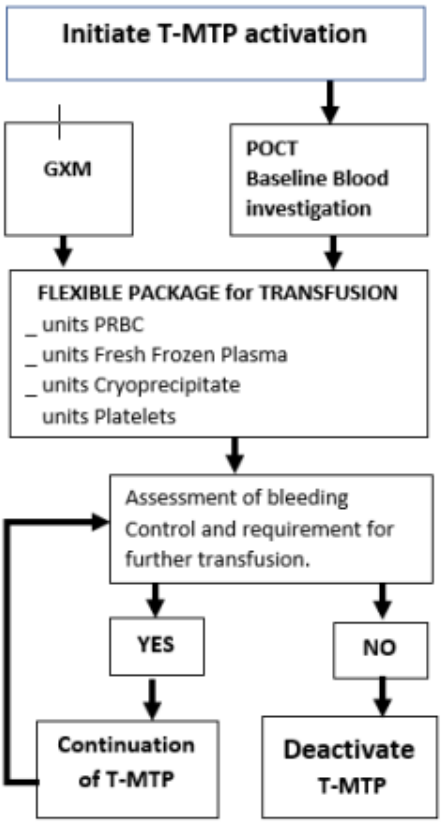
Accurate patient identification, appropriate specimen collection, and relevant clinical information are essential for reliable test results and patient safety.

Test	Special Requirement
Group, Screen and Hold (GSH) & Group, Screen and Crossmatch (GXM)	**Patient ≥ 6 months old & adult** i. A second specimen is required for ABO blood group confirmation if no previous valid ABO blood group record is available in the laboratory information system. ii. Need MO code
	Patient < 6 months old i. The infant's specimen must **ALWAYS** be accompanied by the maternal specimen. ii. If a maternal specimen is unavailable, 3–5 mL of the infant's EDTA blood specimen is required. iii. Separate Blood Transfusion Request Forms must be completed for the mother and infant. iv. A request barcode shall be generated under the paedy packed red cell request using the mother's details. v. A second maternal specimen is required for ABO blood group confirmation if no previous valid ABO blood group record is available. vi. Need MO code
Blood component request	i. A second specimen is required for ABO blood group confirmation if no previous valid ABO blood group record is available. ii. For patients with at least two previous blood grouping records in eHIS, a new blood sample is **NOT** required to accompany the request for blood components. Only the request form and barcode for blood component are required. iii. Each type of blood component request must be submitted separately with its own request barcode and Blood Transfusion Request Form. iv. Need MO code
GSH/GXM for elective transfusion and surgery	i. Specimens should be submitted during normal working hours. ii. Specimens should be received by the Blood Bank at least 24 hours before the scheduled surgery. iii. Requests shall follow the MSBOS or be based on clinical indication. iv. Conversion from GSH to GXM will be performed during normal working hours v. MO code is required after 5 pm.
Transfusion in an emergency situation	**1st Stage GXM** i. All 1st stage GXM requests must be followed by a telephone call to alert the blood bank staff to facilitate urgent processing. The requesting clinician or house officer shall deliver the specimen directly to the Blood Bank and remain available until the blood component is ready for collection. ii. A second blood specimen for ABO blood group confirmation is **MANDATORY** for patients without a previous valid ABO blood group record in the eHIS. iii. The second specimen must be collected independently at a different time from the initial specimen collection.
	Uncrossmatch Safe O i. In life-threatening emergencies requiring immediate resuscitation, uncrossmatched Group O RhD-positive buffy coat-poor packed red blood cells (Safe O) may be transfused. Safe O units are available in the ED and OT. ii. The decision to transfuse uncrossmatched Safe O blood shall be made only after careful clinical assessment by the responsible clinician and when the benefits outweigh the potential risks. iii. The requesting clinician shall document the indication for transfusing uncrossmatched Safe O blood in the Blood Transfusion Request Form, clinical notes, or the patient's electronic medical record (eHIS) and sign the documentation. iv. A pre-transfusion blood specimen must be collected before transfusion whenever possible. v. The pre-transfusion specimen and the completed transfused Safe O blood bag (or its traceability documentation, according to hospital policy) shall be sent to the Blood Bank immediately for ABO and RhD blood grouping, compatibility testing, and traceability. vi. If any serological incompatibility is identified, the requesting clinician shall be informed immediately. vii. Replacement of the Safe O unit shall be performed after the transfusion episode has been completed and the unit consumption has been recorded by the respective department or clinician in the system.

9. Targeted Massive Transfusion Protocol (T-MTP)

The Targeted Massive Transfusion Protocol (T-MTP) is a strategy designed to provide rapid and individualised blood component therapy for patients with significant haemorrhage. It allows clinicians to determine the appropriate type, quantity, and ratio of blood products required for effective resuscitation. This approach is guided by objective clinical assessment and point-of-care testing (POCT), including full blood count (FBC), blood gas analysis, and viscoelastic haemostatic assays.

i. Activation of the T-MTP shall be decided by the attending specialist.
ii. The attending specialist shall appoint a clinical coordinator to activate and oversee the T-MTP process.
iii. The clinical coordinator shall appoint a designated runner responsible for the transport of blood specimens and blood components.
iv. The Blood Bank shall be notified immediately, with all required clinical and patient information provided.
v. The Blood Bank MO shall be informed of the T-MTP activation.
vi. Ensure that an adequate EDTA blood specimen and a completed Blood Transfusion Request Form are prepared and sent to the Blood Bank.
vii. Ensure that the blood specimen reaches the Blood Bank promptly to avoid delays in blood component provision.
viii. Ensure that the designated runner is equipped with a suitable blood transport container.
ix. The T-MTP shall be deactivated once haemorrhage is controlled and the patient is haemodynamically stable.



10. Massive Transfusion Protocol (MTP)

i. Activation of the MTP shall be authorised by the attending specialist.
ii. The attending specialist shall appoint a clinical coordinator to activate and coordinate the MTP.
iii. The clinical coordinator shall appoint a designated runner to transport blood specimens and blood components.
iv. Notify the Blood Bank immediately and provide all required patient and clinical information.
v. Inform the Blood Bank MO of the MTP activation.
vi. Ensure that an adequate EDTA blood specimen and a completed Blood Transfusion Request Form are sent to the Blood Bank.
vii. Ensure that the blood specimen is delivered to the Blood Bank promptly to avoid delays in blood component provision.
viii. Ensure that the designated runner is equipped with an appropriate blood transport box for collection.
ix. Deactivate the MTP once haemorrhage is controlled and the patient is haemodynamically stable.

Massive Transfusion Protocol (MTP)

RAPID BLOOD LOSS OF MORE THAN 150ML/MIN LEADING TO HAEMODYNAMIC INSTABILITY AND/OR CIRCULATORY FAILURE

ACTIVATION OF MTP:

1.EMERGENCY PHYSICIAN OR PRIMARY TEAM SPECIALIST/CONSULTANT TO INFORM PATHOLOGIST ONCALL

2.ED OR PRIMARY TEAM MO TO INFORM BLOOD BANK MLT/MLT ONCALL

Information required by Blood Bank :

- Name and phone number of senior clinician in charge who activate the MTP
- Patient's detail:
  -name, IC/Passport and RN
  -location
  -cause of bleeding

Sample required by laboratories (baseline & monitoring)

- 10ml (3 tubes) EDTA for GXM for every subsequent cycle required
- FBC and coagulation screen (PT,APTT, INR, fibrinogen) to haematology haemostasis laboratory

Notes :

- Emergency Physician will transfer the responsibility of the MTP to the surgeon or anaesthetist if patient leaves ED
- The Emergency Physician is responsible to terminate the MTP if patient is in ED while the anaesthetist is responsible for patients in OT/ICU
- Rare blood group

ACTIVATE MTP
Notify Transfusion laboratory to:
MO blood bank on call
MLT blood bank on duty : ext 2154

Choose: Code 1 or Code 2

CODE 1	
4 units	PC
4 units	FFP
4 units	Plt

CODE 2	
4 units	PC
4 units	FFP
4 units	Plt
4 units	Cryo

1st cycle : Need sample 10mls in EDTA tubes

2nd cycle: continuous process from 1st cycle

3rd cycle:
Approval from clinician to proceed and 10mls blood sample in EDTA tubes

DEACTIVATE MTP

Definition of massive transfusion:

1. Transfusion of half of one blood volume in 3 hours, or more than one blood volume in 24 hours (adult blood volume is approximately 70mL/kg)
2. Transfusion of more than 40ml of blood/kg in a child (blood volume of children older than neonates is approximately 80 ml/kg).

Availability of blood and blood product for collection In activation of MTP

Blood products	Availability	Transportation
Uncrossmatched safe O	(available on-site/Blood Bank)	ice box with ice
1st stage cross-matched blood	(Within 30 min)	
Full crossmatched blood (PC)	(45 minutes)	
Fresh Frozen Plasma (FFP)	(30 minutes)	
Cryoprecipitate(Cryo)	(30 minutes)	
Platelets (Plt)	(Immediate)	without Ice

11. Selection of Red Cells for Transfusion

i. For routine transfusion, packed red blood cells shall be used in preference to whole blood.
ii. Red blood cell components should be ABO- and RhD-identical to the recipient whenever possible.
iii. For infants < 6 months of age, Group O RhD-positive paediatric packed red blood cells (paediatric pack) shall be used as appropriate.

12. Issuance, Collection & Return of Unused Blood and Blood Component

i. Blood Bank staff shall ensure that the correct blood and blood components are issued.
ii. The date and time of issue and collection shall be documented by Blood Bank personnel.
iii. Records shall include the details of both the issuing officer and the person collecting the blood or blood component.
iv. The person collecting the blood shall provide valid documentary identification of the patient (blood collection slip or barcode label).
v. The person collecting the blood shall verify that the correct blood or blood component has been issued before leaving the Blood Bank counter.
vi. Issued blood components shall be transfused without undue delay.
vii. Blood components shall be stored in approved Blood Bank refrigerators at the appropriate temperature before issue.
viii. Blood components shall only be collected when immediate transfusion is required.
ix. Transportation shall be performed under appropriate conditions to maintain the cold chain.
x. The ward shall store blood components at the recommended temperature and conditions until transfusion or immediate return to the Blood Bank.
xi. Unused blood components shall be returned to the Blood Bank immediately.
xii. The ward shall notify the Blood Bank if any returned Unused blood has not been stored or transported under appropriate temperature conditions.
xiii. Returned blood components that do not meet storage or transport requirements shall be discarded, unless deemed suitable after Blood Bank assessment.
xiv. Records of returned unused blood shall be retained for stock reconciliation at scheduled checks (8.00 am and 2.00 pm daily).

13. Administration of Blood Components

i. Patient identification shall be confirmed by asking the patient or relative (where appropriate) and by checking:
    a. Patient's medical record
    b. Compatibility card
    c. Blood request form
    d. Patient identification wristband
    e. Expiry date of the blood component

ii. Details of transfusion shall be documented in the patient's medical record including:
    a. Type of blood component transfused
    b. Blood component barcode number
    c. Date of transfusion
    d. Volume transfused
    e. Start and end time of transfusion
    f. Any adverse transfusion reactions

iii. The patient shall be closely monitored during the transfusion. Monitoring parameters include:
    a. Blood pressure and pulse rate
    b. Temperature
    c. Clinical features of acute transfusion reactions

iv. Vital signs shall be recorded:
    a. Before transfusion
    b. During transfusion (frequent observation during the first 5–10 minutes, then every 30 minutes, and hourly thereafter; every 15 minutes for unconscious patients)
    c. After completion of transfusion

14. Return of Used/Empty Blood Bags

i. The ward shall return used/ empty blood bags and completed compatibility cards (PPDK) within 24 hours.
ii. Documentation of unit usage shall be completed in the ward before the return of the used/ empty blood bag.
iii. The compatibility card shall be completed accurately and include at least the following information:
    a. Hospital name
    b. Ward
    c. Patient's full name
    d. Identification card/passport number or hospital registration number
    e. Blood group (ABO and RhD), age, and gender
    f. Date of transfusion
    g. Start and end time of transfusion
    h. Volume transfused
    i. Any adverse transfusion reaction
    j. Name and signature of staff initiating transfusion
    k. Name and signature of staff completing the documentation

iv. Used/empty blood bags shall be retained in the Blood Bank for 7 days.

15. Return of Unused Blood

i. The ward shall return all unused blood components immediately to the Blood Bank.
ii. Returned unused blood components must be maintained under appropriate storage and transport conditions.
iii. The ward shall inform the Blood Bank if any returned blood has not been stored or transported under the required temperature conditions.

16. Storage, Transportation and Duration for Transfusion of Blood

Blood Components	Red cells (all types of red cells)	Platelets	Thawed Plasma	Thawed Cryoprecipitate/ Cryosupernatant
Storage	2 - 6°C	20 - 24°C	Shall be issued once the product is thawed	Shall be issued once the product is thawed
Transportation	2 - 10°C	Should be kept at 20 - 24°C. **NEVER** put platelets in refrigerator	2 - 10°C	20 - 24°C (thawed product)
Transport box	Insulated box with coolant pack. Direct contact with coolant shall be **AVOIDED**	Insulated box **WITHOUT ICE**	Insulated box with coolant pack. Direct contact with coolant shall be **AVOIDED**	Insulated box **WITHOUT ICE**
Duration before transfusion	30 minutes after removing the packs from blood refrigerator	Start as soon as the pack is received from the blood bank	As soon as the thawed pack is received from the blood bank	As soon as the thawed pack is received from the blood bank
Duration during transfusion	**SHOULD NOT** more than 4 hours to completion to avoid risk of bacterial contamination	**SHOULD NOT** be more than 30 minutes		

17. Investigation of Transfusion Reaction

i. All suspected transfusion reactions shall be investigated, reported, and managed accordingly.
ii. If an adverse transfusion reaction is suspected, the transfusion must be stopped immediately.
iii. The attending doctor shall be informed immediately.
iv. The following investigations and samples shall be prepared to facilitate the investigation of the transfusion reaction:
    a. Post-Transfusion Sample I: To send **IMMEDIATELY** within 24 hours after reaction occurred
    b. Post-Transfusion Sample II: To send after 24 hours the reaction occurred (if required)
v. 3-5 ml venous blood in an EDTA tube for:
    a. Repeat ABO grouping/ re-grouping
    b. Repeat crossmatch
    c. DCT and antibody screening
    d. Elution test (when necessary)
vi. Additional blood samples may be required for full blood count (FBC), reticulocyte count, lactate dehydrogenase (LDH), and biochemistry (bilirubin and renal profile), particularly in suspected haemolytic transfusion reactions.
vii. Urine sample (approximately 20 ml) may be collected for haemoglobinuria testing, if indicated.
viii. A new set of empty blood culture bottles (aerobic and anaerobic) should accompany the remaining used blood component for culture at the Blood Bank (if required).
ix. The remaining blood component (used/empty unit) and the infusion set (securely clamped and without needle) shall be sent to the Blood Bank.
x. A completed **Request Form for Transfusion Reaction Investigation (BTS/TR/2/2016)** shall accompany all transfusion reaction investigations request.

18. Transfusion Record

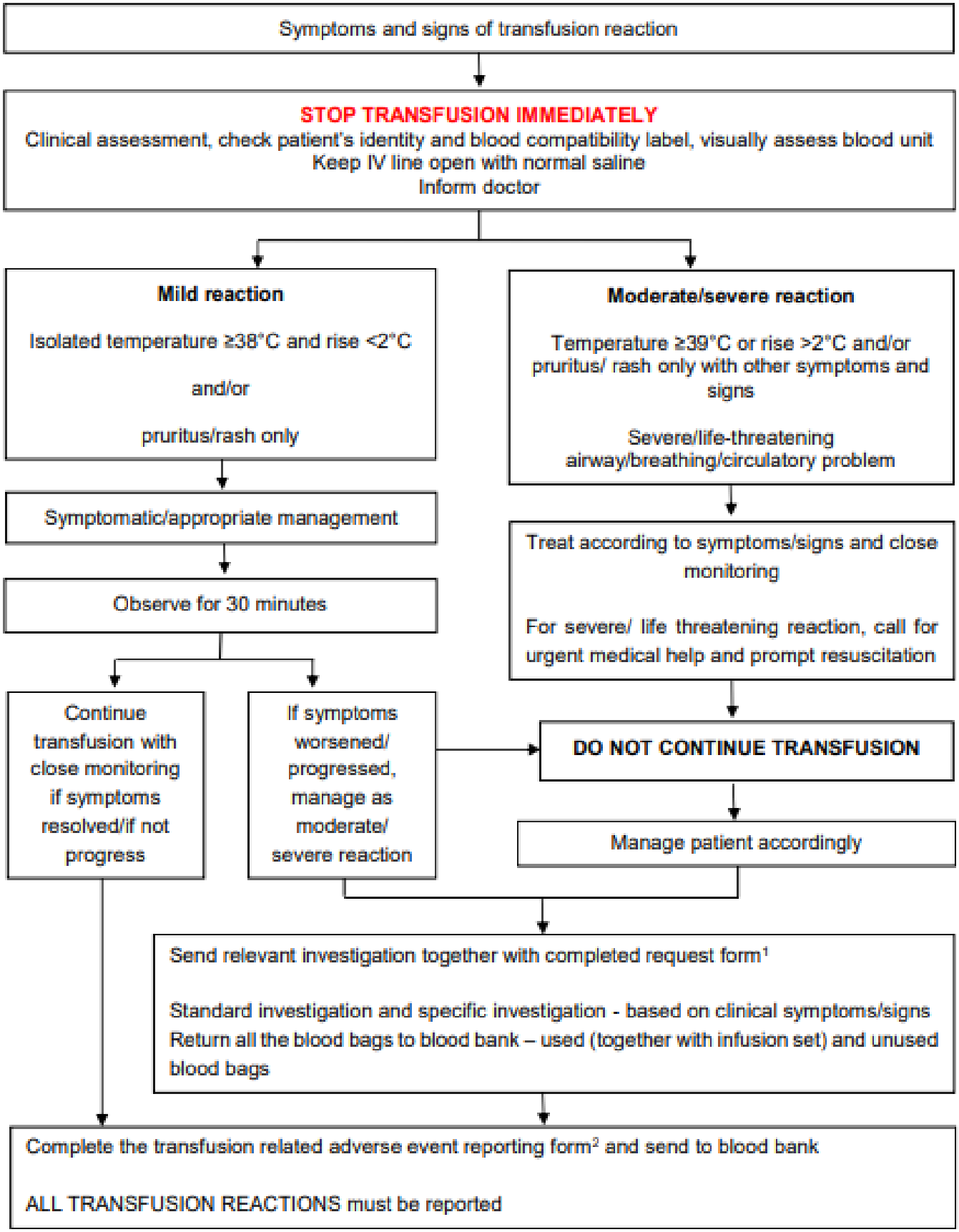
i. All transfusion-related records cases shall be documented and retained in the Blood Bank and the eHIS.
ii. Details of each transfusion, including blood unit identification, shall be recorded in the system and/or on the compatibility card (PPDK).
iii. Return all used/empty blood bags, any unused blood components and the PPDK card to the Blood Bank.

19. Rare Blood Group

Rh(D) negative blood group:

i. Minimal stock available in blood bank (only for emergency use).
ii. For elective procedures with a potential transfusion requirement, the Blood Bank shall be notified at least two weeks in advance.
iii. Early notification is essential to allow adequate time for sourcing compatible blood.
iv. In emergencies where ABO-identical RhD negative blood is not immediately available, the Blood Bank may issue blood in the following order of preference:
    a. Group O RhD negative blood, or
    b. ABO group-specific RhD positive blood, only if the patient does not have pre-formed anti-D
v. The issuance of such blood shall only be performed following consultation with and agreement from the treating clinician.

Figure 16.1: Flowchart for management of acute transfusion reaction



Handbook on Clinical Use of Blood 3rd Edition, 2020

LIST OF TESTS (IN-HOUSE)

Test	Sample Container & Volume	LTAT
ABO Grouping & RhD Typing*	EDTA (2 ml)	2 hours
Antibody Identification	**Adult:** EDTA: 10 ml (3 tubes) **AND** Plain non-gel tube (red cap): 10 ml (3 tubes) **Paediatric (<6 months old):** EDTA: 1-2 ml **AND** Plain non-gel tube (red cap): 1-2 ml ***Send together with mother's samples***	14 working days
Coomb's Test*	EDTA (2 ml)	2 hours
Group, Screen & Crossmatch (GXM)*	EDTA (3-5 ml)	2 hours
Group, Screen & Hold (GSH)*	EDTA (3-5 ml)	2 hours
GSH convert to GXM (cGXM)*	EDTA (3-5 ml) or Uses existing GSH sample (if still valid/ <72 hours)	1 hour
Immediate Spin Phase/ 1st Stage GXM*	EDTA (3-5 ml)	<30 minutes
Urgent Crossmatch (uGXM)*	EDTA (3-5 ml)	45 minutes

LIST OF TESTS (REFERRED)

The laboratory turnaround time (LTAT) is based on working days. For referred tests, the turnaround time (TAT) refers to the processing time of the referral laboratory and excludes the time required for specimen dispatch and the time taken for results to be received, verified, and reported in the hospital system.

Specimen dispatch to referral laboratories is generally performed daily. Upon receipt of the report, most referral laboratories require approximately one working day for result processing and reporting.

Tests referred to external laboratories, including the **Seksyen Makmal Rujukan Immunohematologi Kebangsaan (MRIK)**, **Pusat Darah Negara (PDN)** are listed in the List of Referred Tests.

Test	Sample Volume	Sample Container	Referral lab TAT	Special Requirement/ Forms
ABO Rh Confirmation	**Adult:** EDTA: 10 ml (3 tubes) **AND** Plain non-gel tube (red cap): 10 ml (3 tubes) ***Paediatric** (<6 months old): EDTA: 1-2 ml **AND** Plain non-gel tube (red cap): 1-2 ml ***Send together with mother's samples*** Send 5–10 ml of saliva for secretor study (Bombay/ Para-Bombay cases only)	EDTA Plain non-gel tube (red cap) Universal container *(for saliva)*	**Serology:** 10 working days **With molecular:** 20 working days *LTAT may vary depending on complexity of case*	Borang Pemohonan Transfusi Darah Permohonan Rujukan Ujian Immunohematologi In NAIT cases, samples must be obtained from biologically related parents only. Sample must be fresh
Antibody Identification				
Cold Agglutinin Titre				
Isohemagglutinin (Titre Anti-A & Anti-B)				
Platelet Immunology Test				
RBC Phenotype				

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

LIST OF REQUEST FORMS

Forms	Code	Description
Borang Pemohonan Transfusi Darah	PER-SS-BT 105 (Pind. 1/2016)	For all tests in Transfusion Medicine
Borang Persetujuan Pemindahan Darah atau Komponen Darah	BTS/TC/2/2016	Consent form for patient
Request Form for Transfusion Reaction Investigation (Blood and Blood Components)	BTS/TR/2/2016	Transfusion Reaction Reporting (For clinician to fill up)
General PER-PAT Form	PER-PAT 301	RBC Phenotyping & other tests
Manual Blood Collection & Transfusion Slip	Form/TR/027-Ver01	For downtime only

All request forms can be downloaded via the hyperlinks or from Public Folder > Borang-Borang > Borang Pathology > Borang Unit Perubatan Transfusi

MEDICAL MICROBIOLOGY

INTRODUCTION

Medical Microbiology unit is a full-service laboratory offering diagnostic, consultative, training, research and development services in diagnostic bacteriology, virology, mycology, parasitology, immunology and mycobacteriology.

Services also include tests for screening and monitoring of diseases. The laboratory also participates in hospital wide infection control activities in relation to surveillance, control and prevention of nosocomial infections.

SPECIFIC SAMPLE COLLECTION GUIDELINE

Bacteriology	
Autopsy material	**Blood** i. Aspirate 10 ml of blood from right heart either through skin and chest wall or (through unopened heart) from right ventricle after removal of sternum into a set of blood culture bottle ii. Avoid contamination with bacteria from the water faucet and with enteric bacteria iii. Send the specimens immediately to the laboratory at ambient temperature **Tissue** i. Best collected before the body is being handled at an earlier stage ii. Decontaminate the skin or sear surface of heart or other organ before inserting needle or cutting out tissue block iii. Collect the tissue and placed in a sterile container. Large piece is preferred (because aseptic collection is difficult) iv. Send specimens immediately to the laboratory. If transport is delayed, refrigerate sample at 2-8°C
Blood cultures	An automated blood culture system with different types of bottles according to age and indication: i. Adults: Aerobic and anaerobic culture bottle Volume: 8 – 10 ml each bottle ii. Paediatric: A single paediatric blood culture bottle Volume: 1 – 3 ml iii. Fungal C&S: Mycobacteria/Yeast/Fungi blood culture bottle Volume: 3-5 ml iv. TB Blood Culture: Mycobacteria/Yeast/Fungi blood culture bottle Volume: 3-5 ml **Note:** In the suspicion of catheter-related bacteraemia, blood drawn from both the line and peripheral vein is indicated. Send the specimens immediately to the laboratory at ambient temperature.
Bone marrow aspirate	3 – 5 ml of aspirate is required and to be inoculated directly into the Mycobacteria/ Yeast/ Fungi blood culture bottles. (validated) i. Before venepuncture, the skin must be carefully disinfected with alcoholic antiseptic ii. Clean the tops of the bottle with alcohol iii. Inoculate the specified volume of blood / bone marrow aspirate into each bottle iv. Send the specimens immediately to the laboratory at ambient temperature
Cerebrospinal Fluid (CSF)	i. Collect 3 – 4 ml of CSF into sterile Bijoux bottles for the examination of: • microscopy and culture for bacterial and fungi (if indicated) ii. Send the specimen immediately to the laboratory iii. Do **NOT** refrigerate specimen
Clostridium difficile Antigen/Toxin	i. Collect fresh stool in a sterile container. Specimens collected in formalin or swabs are not acceptable ii. Transport to the laboratory immediately. If transport is delayed, refrigerate sample at 2-8°C
Genital samples	**High vaginal swabs** i. This is suitable for the diagnosis of candidiasis and other causes of vaginitis but NOT gonorrhoea in the female ii. Using a sterile speculum lubricated with sterile normal saline and not antiseptic cream, swab either from the posterior fornix or the lateral wall of the vagina iii. Inoculate the swab into Amies transport media and send the specimen to the laboratory as soon as possible

Bacteriology	
	Endocervical swab i. This is the best specimen for the diagnosis of gonorrhoea and puerperal sepsis ii. Under direct vision, gently compress cervix with blades of speculum and use a rotating motion with swab, obtain exudates from the endocervical canal iii. Inoculate the swab into Amies transport media **Urethral discharge (Male)** i. Wipe the urethra with a sterile gauze or swab ii. Collect the exudates with a sterile swab and inoculate into Amies transport media iii. If discharge cannot be obtained by 'milking' the urethra, use a sterile swab to collect material from about 2 cm inside the urethra iv. Place the swab into Amies transport media Send specimens immediately to the laboratory. If transport is delayed, refrigerate sample at 2-8°C
Mycobacterium: Acid-fast bacilli stains	Acceptable specimens: Respiratory samples, CSF, body fluids, tissue biopsies **For sputum** i. Collect in a sterile container ii. Collect a minimum of 2 specimens including 1 early morning sputum specimen where possible Send specimens immediately to the laboratory. If transport is delayed, refrigerate sample at 2-8°C
Mycobacterium: Acid-fast bacilli culture	i. Acceptable specimens: Whole blood ii. TB Blood Culture: Mycobacteria/ Yeast/ Fungi blood culture bottle iii. Volume: 3-5 ml iv. For other specimens (e.g respiratory) please refer to List of Tests (Referred) section
Pus/ Swab/ Tissue	i. Send pus aspirate if available, in a sterile universal container ii. Swab is an inferior substitute and should be sent in an Amies transport medium iii. Send all tissues for culture in a sterile container. Do **NOT** add formalin to the specimen iv. For anaerobic culture please send tissue/pus in thioglycolate broth or Robertson Cooked Meat Medium (RCMM). The broth can be collected at laboratory counter **Note:** A 'dry' swab may fail to yield organisms in smear and culture. Surface swabs of deeply infected lesions (e.g.; sinus tracks from osteomyelitis, pressure sores) usually grow surface contaminants like coliforms and pseudomonas. Send specimens immediately to the laboratory. If transport is delayed, refrigerate sample at 2-8°C. 

Bacteriology	
Respiratory specimens	**Nasal swab** i. Commonly done for screening of MRSA carriage ii. Moisten a swab with sterile saline iii. Swab both the anterior nares and insert the swab into the nose and gently rotate against the nasal mucosa iv. Send specimens immediately to the laboratory. If transport is delayed, refrigerate sample at 2-8°C **Throat swab** i. In the majority of cases, throat swabs are obtained to recover Group A Streptococcus (*Streptococcus pyogenes*) which causes pharyngitis or to culture *Corynebacterium diphtheriae* in a presence of suspicious pseudomembrane ii. Ask the patient to open his mouth widely. Gently depress the tongue with a tongue depressor and rub the sterile swab over the tonsillar areas and the mucosa on the posterior pharyngeal wall behind the uvula. iii. Gently turn the swab so that its whole surface comes in contact with the inflamed mucosa or lesion iv. Avoid touching the oral mucosa or tongue with the swab v. Place the swab in Amies transport medium immediately vi. Use polyester, rayon, or nylon swabs only **Swab from mouth, gums and oral cavity** i. Rinse mouth with water before sampling ii. Using a sterile swab, rub into areas of exudation or inflammation and place into Amies transport medium iii. Send at least 2 specimens with one early morning specimen, where possible iv. Send specimens immediately to the laboratory. If transport is delayed, refrigerate sample at 2-8°C **Sputum** i. Collect the sputum early in the morning, after a deep cough or after a session of physiotherapy. If tuberculosis is suspected, send 3 consecutive specimens (1 specimen per- day) ii. Ask the patient to cough deeply and spit directly into a sterile universal container iii. The material expectorated should be secretions from the bronchi and not merely saliva from the mouth iv. Send specimens immediately to the laboratory. If transport is delayed, refrigerate sample at 2-8°C **Bronchial alveolar lavage (BAL) / brushings / biopsies** i. Place the specimen which is obtained via bronchoscopy into a sterile container ii. Send the specimen to the laboratory immediately. If transport is delayed, refrigerate sample at 2-8°C
Stool	i. Collect faeces into a sterile/ clean wide-mouth screw-capped plastic container. ii. If the faeces are liquid, the container may be filled to one-third full (excessive amount will result in spillage when opened) iii. Enrichment medium i.e., Alkaline peptone for *Vibrios* and Selenite F for *Salmonella* can be obtained from the laboratory for bedside inoculation iv. Send specimens immediately to the laboratory. If transport is delayed, refrigerate sample at 2-8°C **Note:** Rectal swab is a poor second-best alternative to faeces. If it is not possible to obtain faeces, collect a specimen by inserting a cotton swab into the rectum. For stool clearance culture in cases of typhoid, stool should only be sent upon *completion* of therapy
Urine	**A. <u>Midstream urine</u>** **Male patients:** i. Withdraw the prepuce and cleanse the glans penis with soapy water and thoroughly rinse with water ii. Pass the first few millimetres of urine to flush out the bacteria from the urethra iii. Collect the mid-stream portion in a sterile universal container and close it tightly **Female patients:** i. Clean the peri-urethral area and perineum with soapy water and thoroughly rinse with water ii. Hold the labia apart during voiding and pass the first few millimetres of urine iii. Collect the midstream portion in a sterile container and close it tightly **B. <u>Catheterized urine</u>** i. Catheter urine specimens should be taken by aseptic puncture of the catheter conduit and syringe out into a sterile container ii. Urine from catheter bags is generally unsuitable for culture **C. <u>Bladder urine</u>** i. This is obtained via suprapubic aspiration or cystoscopically ii. Urine is collected in a sterile container Send specimens immediately to the laboratory within 4 hours. If transport is delayed, refrigerate sample at 2-8°C. Alternatively, the specimen may be collected in a leak proof container with boric acid preservative

Mycology	
Skin, hairs and nails	**General Note:** • Clean cutaneous and scalp lesions with 70% alcohol prior to sampling as this will improve the chances of detecting fungus on microscopic examination, as well as reducing the likelihood of bacterial contamination of cultures. Prior cleaning is essential if ointments, creams or powders have been applied to the lesion • Skin, nails and hair specimens should be collected into folded squares of paper or directly onto an agar plate • Send the specimen at room temperature and do **NOT** refrigerate **Skin** • Material should be collected from cutaneous lesions by scraping outwards from the margin of the lesion with the edge of a glass microscope slide or a blunt scalpel **Hairs** • Specimen from the scalp should include hair roots, the contents of plugged follicles and skin scales • Hairs should be plucked from the scalp with forceps or the scalp is brushed with a plastic hairbrush and collected onto an agar plate **Nails** • Nail specimens should be taken from any discoloured, dystrophic or brittle parts of the nail • Specimen should be cut as far back as possible from the edge of the nail and should include the full thickness of the nail Send the specimen at room temperature and do **NOT** refrigerate
Mouth	• Swabs from the buccal mucosa should be moistened with sterile water prior to taking the sample and sent in Amies transport medium • Send the specimen at room temperature and do **NOT** refrigerate
Ear	• Scrapings of material from the ear canal are to be preferred, although swabs can also be use • Send the specimen at room temperature and do **NOT** refrigerate
Ocular specimens	• Material from patients with suspected fungal infection of the cornea (keratomycosis) should be collected by scraping the ulcer. The entire base of the ulcer, as well as the edges, should be scrapped. (Swabs are not suitable for sampling corneal lesions) • The material is collected directly onto agar plates for culture and to a glass slide for microscopic examination • Send the specimen at room temperature and do **NOT** refrigerate
Blood	• Blood culture for fungal is collected in the same manner as for blood culture for bacterial using a manufacturer fungal bottle • The request for fungal culture should be indicated clearly on the request form and a total of two weeks incubation will be carried out • Send the specimen at room temperature and do **NOT** refrigerate
Bone marrow	• This specimen is helpful for making the diagnosis in a number of deep fungal infections, including histoplasmosis and cryptococcosis. • 1 – 5 ml of aspirated material should be collected and transferred into a manufacturer blood culture bottle • Send the specimen at room temperature and do **NOT** refrigerate
Cerebrospinal Fluid (CSF)	• CSF specimens (3 – 5 ml) should be collected in a sterile container for microscopy and culture • Send the specimen immediately at room temperature and do **NOT** refrigerate
Pus	• Pus from undrained subcutaneous abscesses or sinus tracts should be collected with a sterile needle and syringe • If grains are visible in the pus (as in mycetoma), these must be collected. In mycetoma, if the crusts at the opening of the sinus tracts are lifted, grains can often be found in the pus underneath • Send the specimen at room temperature and do **NOT** refrigerate
Tissue	• If possible, material should be obtained from both the middle and edge of the lesions • Small cutaneous, subcutaneous or mucosal lesions can often be excised completely • Tissue specimens should be placed in a sterile container without formalin • Send the specimen at room temperature and do **NOT** refrigerate
Vagina	• For vaginal infections, swabs should be taken from discharge in the vagina and from the lateral vaginal walls. The swabs should be sent to the laboratory in transport medium • Send the specimen at room temperature and do **NOT** refrigerate

Serology & Virology	
Blood	i. Collect 3 – 5 ml of blood in plain tube (without anticoagulant). ii. Clot at room temperature iii. Dispatch to the laboratory within 4 hours of collection for serum separation by centrifugation iv. Send the specimen at room temperature and do **NOT** refrigerate **Note:** Haemolysed, icteric or lipemic specimens invalidate certain tests. If such specimens are received, the samples will be rejected to assure that results are of clinical value
Serum	i. Follow procedure as for blood collection above and centrifuge the collected blood at 3,000 rpm for 10 minutes ii. For external users, aliquot the serum into sterile tube iii. Ensure the temperature is maintained between 2 - 8°C throughout transportation.
Cerebrospinal Fluid (CSF)	i. Collect 2 ml of CSF into a sterile container ii. Ensure the temperature is maintained between 2 - 8°C throughout transportation **Note:** Blood-stained specimens invalidate certain tests. If such specimens are received, the samples will be rejected to assure that results are of clinical value
Urine	i. Collect 5 ml of urine into a sterile container ii. Ensure the temperature is maintained between 2 - 8°C throughout transportation

Viral Genome Detection using Polymerase Chain Reaction (PCR) method	
Blood	i. Collect 5 ml of blood into EDTA tube ii. Send directly to laboratory within 4 hours after collection iii. Send the specimen at room temperature and do **NOT** refrigerate
Plasma	i. Follow procedure as for blood collection above and centrifuge the collected blood at 3,000 rpm for 20 minutes ii. For external users, aliquot the plasma into sterile tube iii. Ensure the temperature is maintained between 2 - 8°C throughout transportation
Cerebrospinal Fluid (CSF)	i. Collect 0.5 ml of CSF into a sterile Bijoux bottle ii. Send directly to laboratory within 2 hours after collection iii. Ensure the temperature is maintained between 2 - 8°C throughout transportation
Urine	i. Collect 5 ml of urine into a sterile container ii. For BKV Genome Detection, transfer the urine into the PCR Media tube within 24 hours after collection iii. Ensure the temperature is maintained between 2 - 8°C throughout transportation
Tissue Biopsy	i. Collect a small specimen, minimum roughly of 0.3 cm size ii. Specimen should consist of both the middle and the edge section of the tissue (if possible) iii. Place tissue in an empty sterile container and do not add formalin into the specimen iv. Send directly to laboratory within 2 hours after collection v. Ensure the temperature is maintained between 2 - 8°C throughout transportation
Ocular specimens	i. Collect specimen from patient with suspected infection of cornea (ocular fluid) ii. Place specimen into an empty sterile Bijoux bottle iii. Send directly to laboratory within 2 hours after collection iv. Ensure the temperature is maintained between 2 - 8°C throughout transportation
Vesicle fluids	i. Collect a minimum of 0.3 ml of sample using a sterile needle by puncturing the lesion or Dacron swab ii. Place specimen into an empty sterile Bijoux bottle or Viral Transport Medium (VTM) iii. Sent directly to laboratory in ice within 2 hours after collection. iv. Ensure the temperature is maintained between 2 - 8°C throughout transportation
Respiratory specimen	i. Nasopharyngeal/ Oropharyngeal swab to be sent in Universal Transport Medium (UTM) or Viral Transport Medium (VTM), packed in ice using triple layer packaging and send to laboratory immediately. Ensure the temperature is maintained between 2 - 8°C throughout transportation ii. BAL/ Sputum/ Tracheal aspirate needs to be sent in sterile container, packed with ice using triple layer packaging and send to laboratory immediately. Ensure the temperature is maintained between 2 - 8°C throughout transportation

HIV-1 RNA, HCV RNA & HBV DNA Viral Load (Quantitative Assay by PCR method)	
Blood	i. Collect 10 ml of blood into an EDTA tube ii. Send directly to laboratory within 4 hours after collection iii. Send the specimen at room temperature and do **NOT** refrigerate
Plasma	i. Follow procedure as for blood collection above and centrifuge the collected blood at 3,000 rpm for 20 minutes ii. For external users, aliquot the plasma into sterile tube iii. Ensure the temperature is maintained between 2 - 8°C throughout transportation

HIV Drug Resistance Test	
Blood	i. Collect 10 ml of blood into each of 2 EDTA tubes ii. Send directly to laboratory within 4 hours after collection iii. Send the specimen at room temperature and do **NOT** refrigerate
Plasma	i. Follow procedure as for blood collection above and centrifuge the collected blood at 3,000 rpm for 20 minutes ii. For external users, aliquot the plasma into sterile tube iii. Ensure the temperature is maintained between 2 - 8°C throughout transportation

Viral Isolation	
Blood	i. Sample should be taken as early as possible ii. Collect aseptically 5 – 10 ml of blood (3 – 5 ml for children) iii. Send it to the lab as soon as possible
Brain tissue for viral diagnosis	i. Remove portions, about 1.5 cm cube of various parts of the brain and the upper spinal cord with as little contamination as possible ii. Place tissue in a sterile container and send it the lab as soon as possible.
Cerebrospinal fluid (CSF)	i. Aseptically collect 1 – 3 ml into a sterile container ii. Send it to the lab as soon as possible
Vesicular lesion	i. Deroof a fresh vesicular lesion using sterile needle and swab the base of the vesicle with sterile Dacron swab ii. Place swab lesion into VTM iii. Send it to the lab as soon as possible
Conjunctival scraping	i. Collect the scraping ii. Send it to the lab as soon as possible
Eye swab	i. Firmly rub the lesion with a sterile swab, which has been moistened with sterile distilled water ii. Put the swab into (VTM) **Note:** ***DO NOT*** *moisten swab with normal saline*
Throat swab	i. Put the patient at a sitting position. Ask the patient to tilt the head slightly and open the mouth ii. Depress the tongue with tongue depressor. Use a sweeping motion to swab the posterior pharyngeal wall and tonsillar pillars. Have the patient say "aah" to elevate the uvula. **Note:** *Use Dacron swab.* ***DO NOT*** *use calcium alginate or cotton swabs or ones with wooden sticks* i. Avoid swabbing the soft palate and do not touch the tongue with the swab tip. This procedure can induce the gag reflex. ii. Place the swab immediately into VTM iii. Send it to the lab as soon as possible
Nasopharyngeal swab (NPS)	i. Insert a flexible, fine shafted flocked swab into the nostril and back to the nasopharynx ii. The swab should be slid straight into the nostril with the patient's head held slightly back iii. The swab is inserted following the base of the nostril towards the auditory pit and will need to be inserted at least 5 – 6 cm in adults to ensure that it reaches the posterior pharynx

Viral Isolation	
	Note: ***DO NOT*** *use rigid shafted swabs for this sampling method – a flexible shafted swab is essential* i. Leave the swab in place for a few seconds. Withdraw slowly with a rotating motion. ii. Put the tip of swab into VTM iii. Send it to the lab as soon as possible
Nasopharyngeal aspirate (NPA)	i. Patient must sit comfortably, and the head tilted slightly backward. Instil 1 – 1.5 ml of sterile, physiological saline (pH 7.0) into one nostril ii. Flush 3 cc syringe with 2 – 3 ml of saline. Insert the syringe into the nostril parallel to the palate. Flush in and out few times iii. Aspirate nasopharyngeal secretions and collect specimens in sterile container.

LIST OF TESTS (IN-HOUSE)

Bacteriology & Mycology

Test	Specimen	Volume	Container	TAT
AFB smear microscopy*	Sputum CSF Body fluid BAL Biopsies Bone marrow	Not applicable	Sputum cup Sterile container	4 hours
Antifungal sensitivity testing*	Fungal isolates	Not applicable	Culture	7 days
Cryptococcal Antigen*	CSF	2 ml	Bijou bottle/ Sterile container	1 day
Clostridium Difficile Antigen/Toxin*	Stool	3 ml	Stool/ Sterile container	1 day
Culture & Sensitivity (C&S) Blood (Aerobic)*	Blood	8 - 10 ml	Aerobic blood culture bottle	8 days
Culture & Sensitivity (C&S) Blood (Anaerobic)*	Blood	8 - 10 ml	Anaerobic blood culture bottle	8 days
Culture & Sensitivity (C&S) Blood (Paediatric)*	Blood	1 - 3 ml	Paediatric blood culture bottle	8 days
Culture & Sensitivity (C&S) Blood Fungal*	Blood	3 - 5 ml	Blood Myco/F Lytic bottle	30 days
Culture & Sensitivity (C&S) Blood Mycobacterium*	Blood	3 - 5 ml	Blood Myco/F Lytic bottle	42 days
Culture & Sensitivity (C&S) Body Fluid*	Aqueous fluid Pericardial fluid Peritoneal fluid Pleural fluid Synovial fluid Vitreous fluid	1 - 3 ml	Sterile container	14 days
Culture & Sensitivity (C&S) Cerebrospinal Fluid*	CSF	3 ml	Bijou bottle/ Sterile container	14 days
Culture & Sensitivity (C&S) Ear and Eye Swab*	Pus swab	Not applicable	Amies transport media	14 days
Culture & Sensitivity (C&S) Fungal*	BAL Cornea CSF Hair Nail Pus aspirate Sputum Skin Tissue	Not applicable	Sterile container	28 days

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Test	Specimen	Volume	Container	TAT
Culture & Sensitivity (C&S) Genital*	Endocervical swab HVS LVS Penile swab Urethral swab	Not applicable	Amies transport media	8 days
Culture & Sensitivity (C&S) Implant/ Device*	IUCD IVDC Screw	Not applicable	Sterile container	8 days
Culture & Sensitivity (C&S) for MRSA*	Axillary swab Groin swab Nasal swab	Not applicable	Amies transport media	5 days
Culture & Sensitivity (C&S) Pus (Aerobic)*	Pus swab Pus aspirate	Not applicable	Amies transport media Sterile container Thioglycolate RCMM	8 days
Culture & Sensitivity (C&S) Respiratory*	BAL Sputum Tracheal aspirate Throat swab	Not applicable	Sterile container	8 days
Culture & Sensitivity (C&S) Rectal Swab (CRE)*	Rectal swab	Not applicable	Amies transport media	5 days
Culture & Sensitivity (C&S) Rectal Swab (VRE)*	Rectal swab	Not applicable	Amies transport media	5 days
Culture & Sensitivity (C&S) Sterility*	Contact lens solution Control saline Corneal storage medium	3 ml	Sterile container	8 days
Culture & Sensitivity (C&S) Stool*	Stool	Not applicable	Cary Blair transport media Stool/ Sterile container	8 days
Culture & Sensitivity (C&S) Tissue*	Bone Corneal scrapping Tissue	Not applicable	Sterile container/ Direct plate inoculation (corneal scrapping)	8 days
Culture & Sensitivity (C&S) Urine*	Catheter Midstream urine Nephrostomy Suprapubic aspirate	1 – 2 ml	Sterile container	5 days
Rotavirus Antigen	Stool	3 ml	Stool/ Sterile container	1 day
Skin Slit Smear	Skin slit smear	Not applicable	Not applicable	5 days

Parasitology

Test	Specimen	Volume	Container	TAT
Blood Film Malaria Parasites (BFMP)*	Blood	Smear EDTA: 5 ml	Thick/ thin film EDTA tube	Smear: 2 hours EDTA: 4 hours
Blood Film Microfilaria*	Blood (preferably midnight sample)	Smear	Thick smear	4 hours
Blood Film for Other Parasites	Blood	Smear	Thin smear	1 day
Stool for Ova & Cyst*	Stool	3 ml	Stool/ Sterile container	4 hours
Trichomonas Vaginalis Microscopy	Urine	3 ml	Sterile container	1 day

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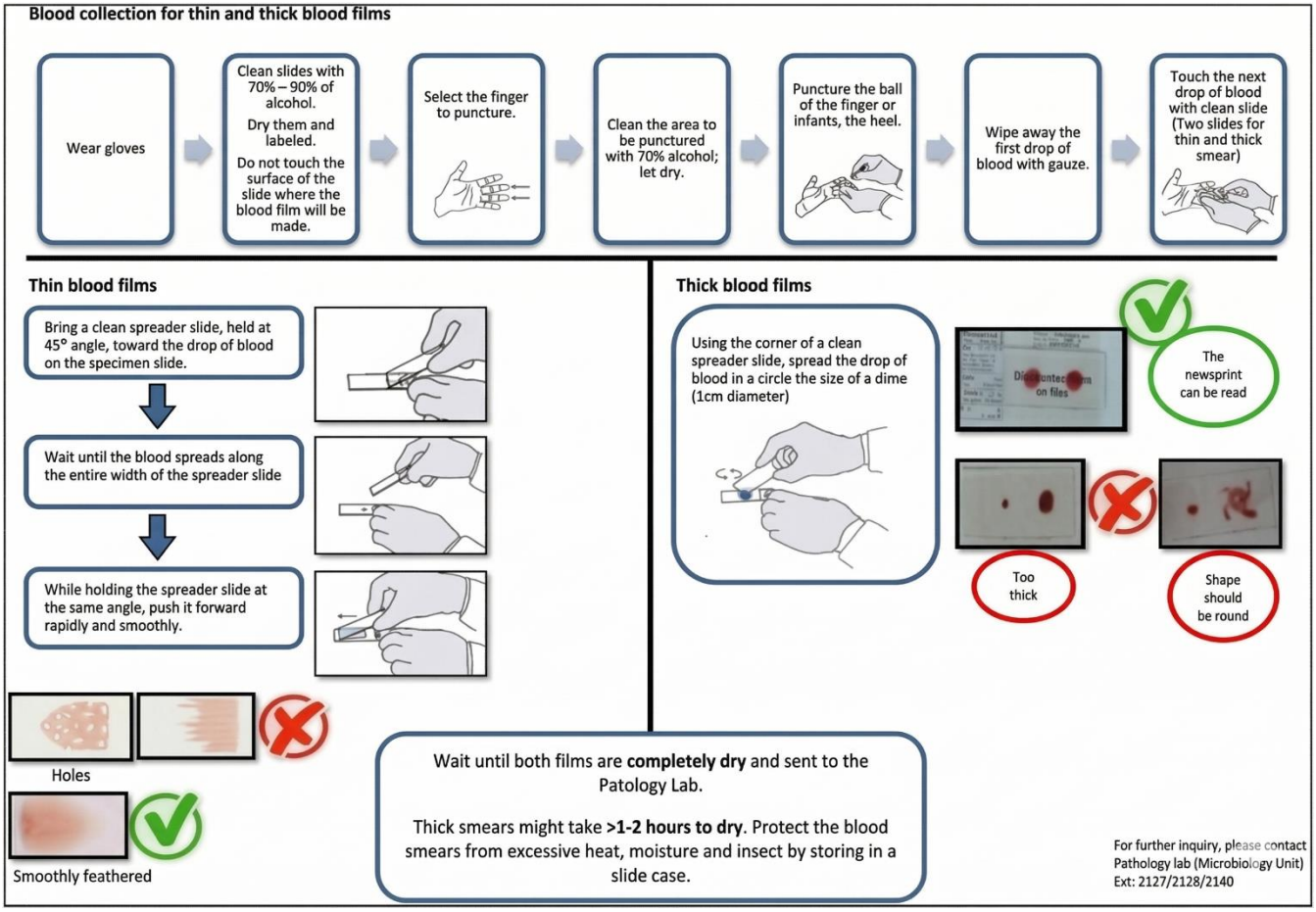
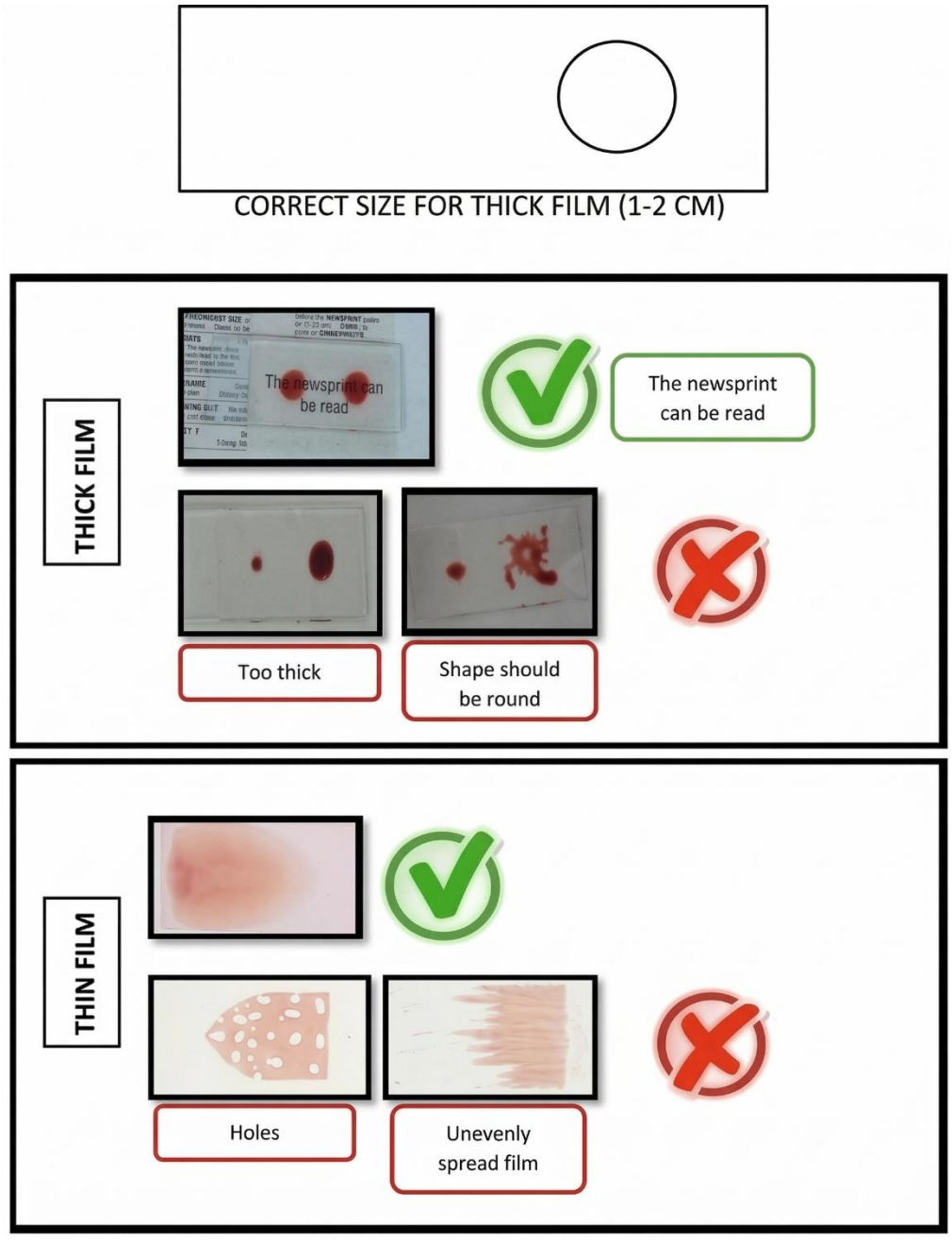
BFMP (Blood Film Malaria Parasite)



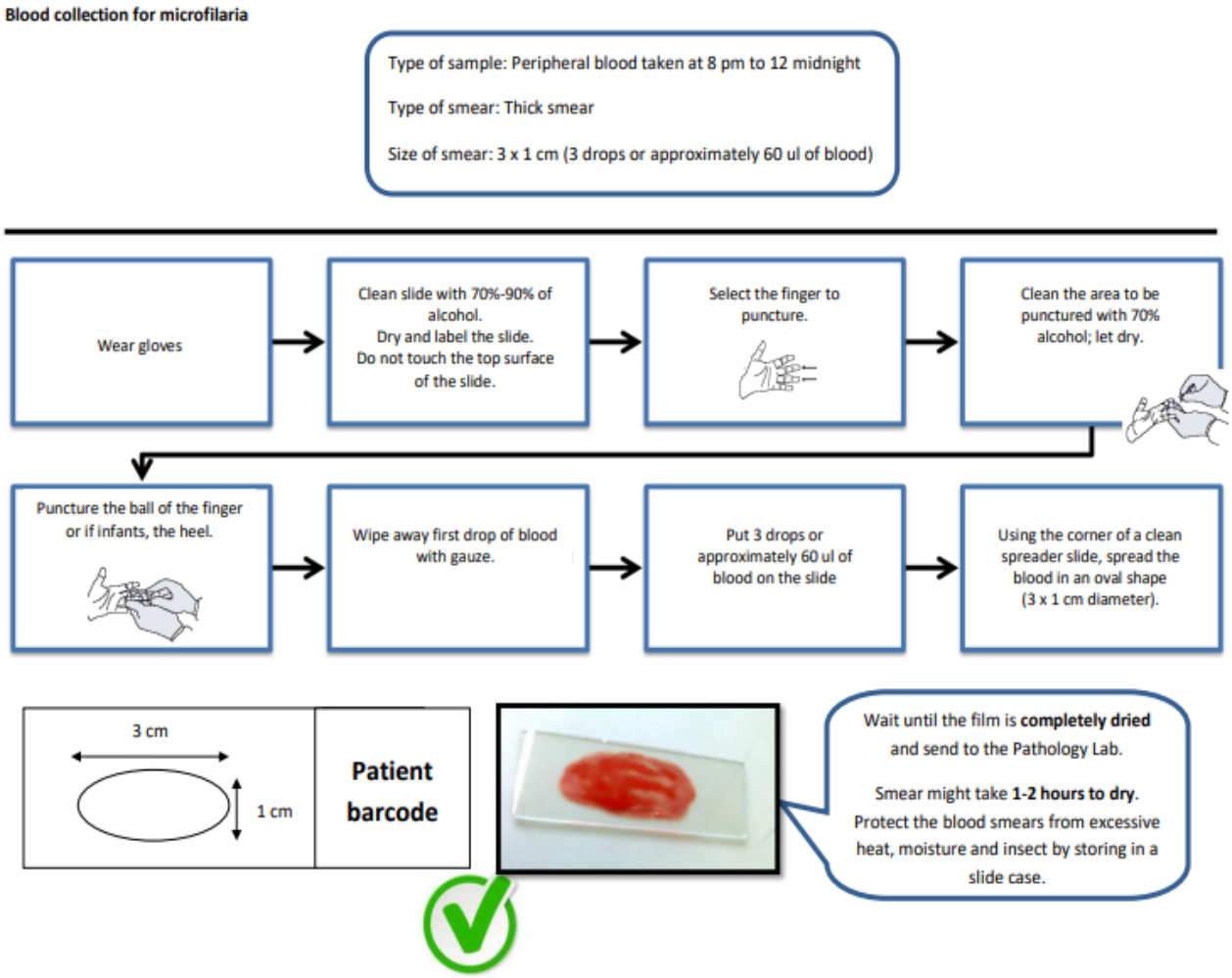
Good quality of BFMP slide

- Completely dry
- Label with patient name/ SB Number/ date
- Thick smear: Size 1-2 cm diameter
- Able to read newspaper through it
- Thin smear: Rounded end

Thick/ Thin Blood Film Malaria Parasite



Blood Film Microfilaria



Molecular

Test	Specimen	Volume	Container	TAT
BK Virus (BKV) Genome Detection*	CSF	0.5 – 2 ml	Sterile container	5 days
BK Virus (BKV) DNA Viral Load*	Plasma Urine	5 ml 5 ml	EDTA tube Urine PCR Media	5 days
Cytomegalovirus (CMV) Genome Detection*	CSF Urine	0.5 – 2 ml 5 ml	Sterile container Sterile container	5 days
Cytomegalovirus (CMV) DNA Viral Load*	Plasma	5 ml	EDTA tube	5 days
Epstein-Barr Virus (EBV) Genome Detection*	BAL CSF	5 ml 0.5 – 2 ml	EDTA tube Sterile container	5 days
Epstein-Barr Virus (EBV) DNA Viral Load*	Plasma	5 ml	EDTA tube	5 days
HBV DNA Viral Load*	Plasma	10 ml	EDTA tube	5 days
HCV RNA Viral Load*	Plasma	10 ml	EDTA tube	5 days
Herpes Simplex Virus ½ (HSV ½) Genome Detection*	Plasma CSF Urine Genital Swab Vesicle Swab	5 ml 0.5 – 2 ml 5 ml Not applicable Not applicable	EDTA tube Sterile container Sterile container VTM VTM	5 days
HIV-1 Drug Resistance Test (Selangor only) (Request by ID Physician only)	Plasma	10 ml (2 tubes)	EDTA tube	8 weeks
HIV-1 RNA Viral Load*	Plasma	10 ml	EDTA tube	5 days
JC Virus (JCV) Genome Detection*	Plasma	5 ml	EDTA tube	5 days

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Test	Specimen	Volume	Container	TAT
	CSF Urine	0.5 – 2 ml 5 ml	Sterile container Sterile container	
Meningoencephalitis Pathogen Genome Detection (by consultation only)*	CSF	0.5 – 2 ml	Sterile container	2 days
MERS Coronavirus Genome Detection*	Nasopharyngeal/ Oropharyngeal swab BAL Sputum Tracheal aspirate Nasopharyngeal aspirate	Not applicable 5 ml 1 ml 5 ml 5 ml	VTM Sterile container Sterile container Sterile container Sterile container	2 days
Mycobacterium tuberculosis Rapid PCR	Sputum CSF BAL	1 ml 2 ml 5 ml	Sterile container Sterile container Sterile container	3 days
Pneumocystis jirovecii Genome Detection	BAL Bronchoalveolar aspirate Sputum	5 ml 5 ml 1 ml	Sterile container Sterile container Sterile container	10 days
Respiratory Pathogen Genome Detection (by consultation only)	Nasopharyngeal swab	Not applicable	UTM	2 days
SARS-CoV-2 Genome Detection*	Nasopharyngeal/ Oropharyngeal swab	Not applicable	VTM	2 days
Varicella-Zoster Virus (VZV) Genome Detection*	Plasma CSF Vesicle Swab	5 ml 0.5 – 2 ml Not applicable	EDTA tube Sterile container VTM	5 days

Serology and Virology

Test	Specimen	Volume	Container	TAT
Anti-double stranded DNA*	Blood	3 - 5 ml	Plain tube	14 days
Anti-Nuclear Antibody*	Blood	3 - 5 ml	Plain tube	10 days
Aspergillus Galactomannan Antigen	Blood BAL	3 - 5 ml	Plain tube Sterile container	7 days
Bartonella Serology	Blood	3 - 5 ml	Plain tube	10 days
(1,3)-Beta-D-Glucan Antigen	Blood	3 - 5 ml	Plain tube	7 days
Borrelia Burgdorferi IgG	Blood	3 - 5 ml	Plain tube	10 days
Borrelia Burgdorferi IgM	Blood	3 - 5 ml	Plain tube	10 days
Chikungunya IgM/IgG	Blood	3 - 5 ml	Plain tube	7 days
Coxiella Burnetii phase II IgG	Blood	3 - 5 ml	Plain tube	10 days
Coxiella Burnetii phase II IgM	Blood	3 - 5 ml	Plain tube	10 days
CSF VDRL*	CSF	0.5 - 2 ml	Sterile container	3 days
Cytomegalovirus IgG*	Blood	3 - 5 ml	Plain tube	7 days
Cytomegalovirus IgM*	Blood	3 - 5 ml	Plain tube	7 days
Dengue IgG ELISA*	Blood	3 - 5 ml	Plain tube	3 days
Dengue IgM ELISA*	Blood	3 - 5 ml	Plain tube	3 days
Dengue NS1 Antigen ELISA	Blood	3 - 5 ml	Plain tube	3 days
Dengue NS1 Antigen (Rapid)*	Blood	3 - 5 ml	Plain tube	1 day
Dengue IgG/IgM (Rapid)*	Blood	3 - 5 ml	Plain tube	1 day

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Test	Specimen	Volume	Container	TAT
Epstein-Barr Virus IgG*	Blood	3 - 5 ml	Plain tube	7 days
Epstein-Barr Virus IgM*	Blood	3 - 5 ml	Plain tube	7 days
Extractable Nuclear Antigen*	Blood	3 - 5 ml	Plain tube	10 days
Hepatitis A IgM*	Blood	3 - 5 ml	Plain tube	7 days
Hepatitis B core IgM*	Blood	3 - 5 ml	Plain tube	7 days
Hepatitis B core Ab Total*	Blood	3 - 5 ml	Plain tube	7 days
Hepatitis B e Ab*	Blood	3 - 5 ml	Plain tube	7 days
Hepatitis B e Ag*	Blood	3 - 5 ml	Plain tube	7 days
Hepatitis B surface Ab*	Blood	3 - 5 ml	Plain tube	3 days
Hepatitis B surface Ag*	Blood	3 - 5 ml	Plain tube	3 days
Hepatitis C Ab*	Blood	3 - 5 ml	Plain tube	3 days
Herpes Simplex Virus I + 2 IgG	Blood	3 - 5 ml	Plain tube	7 days
Herpes Simplex Virus I + 2 IgM	Blood	3 - 5 ml	Plain tube	7 days
HIV combo*	Blood	3 - 5 ml	Plain tube	3 days
Legionella Antigen*	Urine	3 - 5 ml	Sterile container	7 days
Leptospira IgM*	Blood	3 - 5 ml	Plain tube	3 days
Measles Virus IgG*	Blood	3 - 5 ml	Plain tube	7 days
Mumps Virus IgG*	Blood	3 - 5 ml	Plain tube	7 days
Mumps Virus IgM*	Blood	3 - 5 ml	Plain tube	7 days
Mycoplasma Pneumoniae Ab Total*	Blood	3 - 5 ml	Plain tube	7 days
Parvovirus B19 IgG	Blood	3 - 5 ml	Plain tube	7 days
Parvovirus B19 IgM	Blood	3 - 5 ml	Plain tube	7 days
Respiratory Virus Antigen (Rapid)	NPS	Not applicable	Plain flocked swab container	4 hours
Rickettsia Serology*	Blood	3 - 5 ml	Plain tube	10 days
Rubella Virus IgG*	Blood	3 - 5 ml	Plain tube	7 days
Rubella Virus IgM*	Blood	3 - 5 ml	Plain tube	7 days
SARS-CoV-2Antigen (Rapid)	NPS	Not applicable	Plain flocked swab container	4 hours
Syphilis Serology*	Blood	3 - 5 ml	Plain tube	7 days
Syphilis Rapid Plasma Reagin (RPR)*	Blood	3 - 5 ml	Plain tube	7 days
Toxoplasma gondii IgG*	Blood	3 - 5 ml	Plain tube	7 days
Toxoplasma gondii IgM*	Blood	3 - 5 ml	Plain tube	7 days
Varicella Zoster Virus IgG	Blood	3 - 5 ml	Plain tube	7 days
Varicella Zoster Virus IgM	Blood	3 - 5 ml	Plain tube	7 days

** SAMM Accredited Test (MS ISO 15189:2022, No: SAMM 607)*

LIST OF TESTS (REFERRED)

The LTAT stated is based on working days. For referred tests, TAT provided here refers to the referral lab's turnaround time, excluding the time for dispatching of sample to referral lab and the time for the results to be reported or printed in the hospital system.

In general, dispatching to referral lab is done daily, except for National Institute of Health (NIH) and Hospital Putrajaya, refer to Referred Tests section for the transport schedule. As for reporting, lab usually takes 1 working day upon receiving the report.

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
Acanthamoeba spp. PCR	Corneal scraping Contact lens Contact lens suspension CSF	2 ml	Sterile, airtight or contact lens storage	Parasitology, NIH	7 days	General PER-PAT Form
Acanthamoeba spp./ Naegleria spp. microscopy	Corneal scraping Contact lens Contact lens suspension CSF	2 ml	Sterile, airtight container or contact lens storage	Parasitology, NIH	3 days	General PER-PAT Form
Anti-Acetylcholine Receptor Antibody (ACR)	Serum	3-5 ml	Plain tube	Autoimmune, AIRC, NIH	21 days	Autoimmune Request Form
Anti-Aquaporin 4	Serum CSF	3-5ml At least 1 ml	Plain tube Bijou bottle	Autoimmune, NIH	10 days	Autoimmune Request Form
Anti-Glomerular Basement Membrane (GBM)	Serum	3-5 ml	Plain tube	Autoimmune, AIRC, NIH	10 days	Autoimmune Request Form
Anti-Intrinsic Factor Antibody	Serum	3-5 ml	Plain tube	Microbiology, H. Selayang	30 days	General PER-PAT Form
Anti N-Methyl D-Aspartate Receptor (NMDAR) Encephalitis	Serum CSF	3-5 ml At least 1 ml	Plain tube Sterile container/ Bijou bottle	Autoimmune, AIRC, NIH	7 days	Autoimmune Request Form
Anti-Phospholipid (Anti-cardiolipin, Anti β-2 glycoprotein)	Serum	3-5 ml	Plain tube	Microbiology, H. Selayang	30 days	General PER-PAT Form
Bartonella PCR (Aerobic Bacteria)	Blood Tissue (lymph node)	2 ml	EDTA tube Sterile container	Bacteriology, NIH	5 days	By consultation only Bartonellosis Request Form
Bordetella Pertussis PCR	NPA/ Swab Transport in ice or in room temperature	1 - 2 ml	For Nasopharyngeal aspirates, use sterile container For Nasopharyngeal swab, use Dacron swab in Stuart's transport media	Bacteriology, NIH	3 days	Bacteriology Request Form

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
			Bacterial culture, tracheal aspirate, nasal swab: Do not use calcium alginate or cotton swab			
Brucella PCR	Blood	5 ml	EDTA tube Bacteria colony in sealed media plate	Bacteriology, NIH	10 days	Brucellosis Request Form
Brucella Serology (CAPT) (Confirmation)	Serum	2 ml	Plain tube	Bacteriology, NIH	5 days	Brucellosis Request Form
Brucella Serology (ELISA) (Screening)	Serum	2 ml	Plain tube	Bacteriology, NIH	10 days	Brucellosis Request Form
Burkholderia pseudomallei IgM (Melliodosis)	Serum	2 - 3 ml	Plain tube	Bacteriology, NIH	5 days	Bacteriology Request Form
Chikungunya RT-qPCR	Blood Serum	5-10 ml 1-3 ml	EDTA tube Plain tube	Virology, NIH	1 – 10 days	Virology Test Request Form
Cryptosporidium spp./ Microsporidium spp./ Isospora spp. (CMI) Microscopy	Stool	Soft stool 3 ml	Sterile container	Bacteriology, IKN Putrajaya	3 days	Transport day only on Wednesday General PER PAT Request Form
Cyclic Citrullinated Peptide Antibody (IgG)	Blood	3-5 ml	Plain tube	Microbiology, H. Selayang	30 days	General PER-PAT Form
Dengue qRT-PCR	Serum CSF Tissue Biopsy (Post mortem case)	2-4 ml Minimum 1 ml 1.5 cm^3 in a VTM	Plain sterile tube Sterile Bijou bottle Sterile container	Makmal Kesihatan Awam Kebangsaan	14 days	Laboratory Request Form For Dengue and Flavivirus
Dihydrorhodamine assay (DHR) (PID)	Blood	2 ml	Lithium heparin	PID, NIH	10 days	**Strictly no ice** By consultation only, call 03-33628386/ 7412 Primary Immuno-deficiency (PID) Request Form
Ebola Virus RT-qPCR				Virology, NIH	1 – 5 days	By consultation Virology Test Request Form
Enterovirus RT- qPCR (inclusive of Pan Entero, EV 71 and CA16)	CSF Stool	1 – 3 ml > 5 gm (thumb size)	Sterile leakproof container	Virology, NIH	1 – 10 days	By appointment

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
	BAL/ Sputum/ NPA	3 ml				Reach lab within 12 hours after collection Virology Test Request Form
	Organ biopsies	About 1.5 cm cubes from various parts of affected organs				
	Rectal swab/ Throat swab/ Vesical swab/ NPS/ OPS		VTM (Swab)			
Enterovirus Isolation	Stool/ BAL/ sputum	>5gm (thumb size)	Sterile plain container	Virology, NIH	14 – 28 days	Virology Test Request Form
	Pleural fluid	1 - 3 ml				
	CSF	1 - 3 ml				
	Serum	3 - 5 ml				
	Organ biopsies	About 1.5 cm cubes from various parts of affected organs				
	Rectal swab/ throat swab/ vesical swab/ ulcer swab		VTM (Swab)			
Filariasis PCR	Whole blood Blood on slides or filter paper	2.5 ml	EDTA tube Slide mailer or seal plastic bag	Parasitology, NIH	7 days	Blood taken between 6pm-12am General PER-PAT Form
Filariasis Serology	Blood Serum	2 ml 2 ml	EDTA tube Plain tube	Parasitology, NIH	1 day	General PER-PAT Form
Fungal PCR	Blood Tissue CSF Sterile body fluids	2 ml As much as possible	EDTA/ Plain tube/ Blood culture bottle Sterile container	Bacteriology, NIH	14 days	Mycology Request Form
Hepatitis C Virus (HCV) RNA PCR Genotyping (Qualitative)	Blood	5 ml	EDTA tube	Virology, HKL	30 days	Transport in ice General PER-PAT Form
HIV -1 RNA RT PCR for babies (0-18 months)	Blood	3 ml	EDTA tube	Virology, NIH	5 – 10 days	For newborn cases Ujian Polymerase Chain Reaction (PCR) Untuk HIV Virus Di Kalangan Bayi Form
HLA Antibody Test (PRA/ DSA)	Blood	6 ml	Plain tube	Transplantation Immunology, NIH	20 days	HLA Antibody Test Request Form (PRA/DSA)
HLA Crossmatch (Complement Dependent Cytotoxicity)	Blood For solid organ transplantation	Donor: 18 ml Patient: 6 ml	Sodium heparin (donor), Plain tube (patient)	Transplantation Immunology, NIH	10 days	Active by appointment only. Please call 03-33628383/ 8382

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
						HLA Crossmatch Test Request Form (Living Donor)
HLA Crossmatch (Flow Cytometry)	Blood	Donor: 18 ml Patient: 6 ml	Sodium heparin (donor), Plain tube (patient)	Transplantation Immunology, NIH For solid organ transplantation	10 days	Active by appointment only. Please call 03-33628383/ 8382 HLA Crossmatch Test Request Form (Living Donor)
HLA Typing Class I (Loci A, B and C)-low/medium Resolution (SSO/SSP-PCR)	Blood	6 ml	2 EDTA tubes	Transplantation Immunology, NIH	14 days	Active by appointment only. Please call 03-33628383/ 8382 HLA Typing Test Request Form
HLA Typing Class I and II (Loci A, B and DR)- HSCT: New case/ Add donor for existing case	Blood	6 ml	2 EDTA tubes	Transplantation Immunology, NIH	10 days	Active by appointment only. Please call 03-33628383/ 8382 HLA Typing Test Request Form
HLA Typing Class I and II (Loci A, B, C, DR & DQ) – Solid Organ: New case/ Add donor for existing case: HSCT: Confirmation (Low Resolution)	Blood	6 ml	2 EDTA tubes	Transplantation Immunology, NIH	10 days	Active by appointment only. Please call 03-33628383/ 8382 HLA Typing Test Request Form
HLA Typing Class I and II (Loci A, B, C, DR and DQ) – high resolution: HSCT Confirmatory Typing (CT)/ Cord blood/ MSCR search	Blood	6 ml	2 EDTA tubes	Transplantation Immunology, NIH	10 days	Active by appointment only. Please call 03-33628383/ 8382 HLA Typing Test Request Form
HLA Typing Class II (Loci DR,DQ) – Low/medium Resolution (SSO/SSP-PCR)	Blood	6 ml	2 EDTA tubes	Transplantation Immunology, NIH	10 days	Active by appointment only. Please call 03-33628383/ 8382 HLA Typing Test Request Form
HLA Typing for Disease Association per loci	Blood	6 ml	2 EDTA tubes	Transplantation Immunology, NIH	10 days	Active by appointment only. Please call 03-33628383/ 8382 HLA Typing Test Request Form (Disease Association)

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
Hydatid disease/ Echinococcus Diagnosis Serology	Blood	2 ml	Plain/ EDTA tube	Parasitology, NIH	5 days	General PER-PAT Form
Interferon Gamma Release Assay (IGRA)	Whole blood	5 ml (1 ml per tube)	Special 4 tubes bottle from MKAK	Makmal Kesihatan Awam Kebangsaan	Within 10 days or after 22 samples per batch are reached	General PER-PAT Form or Borang Permohonan Ujian Tibi, KKM TBIS 20C
Japanese encephalitis (JE) RT-qPCR	Serum Plasma CSF Organ biopsies	1-3 ml 1-3 ml 1 ml 1.5 cm^3 from various parts of affected organs	Plain tube EDTA tube Sterile container Sterile containers containing VTM	Virology, NIH	5 days	Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK
Japanese encephalitis serology	Serum CSF	2-4 ml 1 ml	Plain tube Bijou Bottle	Makmal Kesihatan Awam Kebangsaan	7 days	Samples should be collected within 5 days from onset of illness Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK
Leishmaniasis Serology	Serum Blood	2 2-3 ml	Plain tube EDTA tube	Parasitology, NIH	5 days	General PER PAT Form
Leptospira Culture	Whole blood	One or two drops (~50 µL) 5 ml	Container must get from NIH Heparin tube	Bacteriology, NIH	21 days	Leptospirosis Laboratory Request Form
Leptospira PCR	Blood Sterile body fluid/ tissue	2-3 ml 2-3 ml	EDTA tube Sterile container	Microbiology, NIH	6 days	Send before start antibiotic Leptospirosis Laboratory Request Form
Leptospiral Microagglutination titre (Lepto MAT)	Serum	5 ml	Plain tube	Microbiology, NIH	6 days	To send paired serum samples Leptospirosis Laboratory Request Form
Malaria PCR	Blood	2.5 ml	EDTA tube	Parasitology, NIH	7 days	General PERPAT Form
Measles IgM	Serum	2 - 4 ml	Plain tube	Makmal Kesihatan Awam Kebangsaan	4 days	Measles-Borang Permohonan dan Keputusan Ujian Makmal
Measles RT- PCR	Urine	Urine: 10 ml	Sterile plain container	Makmal Kesihatan Awam Kebangsaan	14 days	Measles-Borang Permohonan dan Keputusan Ujian Makmal

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
	NPA/ tracheal aspirate/ throat swab	NPA/TA: 1-3 ml	VTM			
Monkeypox qPCR	Lesion fluid aspirate	0.5 - 1 ml	Lesion aspirate/ roof: Sterile leakproof screw capped container Scab/ Crust: Two scabs each from at least two body locations in separate sterile container	Virology, NIH	1 – 5 days	Virology Test Request Form By consultation only
	Lesion roof Scab/ Crust	Put in sterile container by separate sampling site				
	Lesion Fluid Swab Tonsillar Tissue Swab Nasopharyngeal swab	Place into sterile container with 1-2 ml VTM	Sterile polyester or Dacron swab. Break off end of Applicator into screw capped Sterile container. Both dry swabs and swabs in VTM can be used.			
Mycobacterium tuberculosis C&S	Sputum Tissue CSF Pus Body fluids	3 – 5 ml CSF/ fluid/ pus: 1 - 2 ml	Sterile plain container	Makmal Kesihatan Awam Kebangsaan	49 working days	Daily (Office Hour) Borang Permohonan Ujian Tibi, KKM TBIS 20C
Mycobacterium leprae C&S	Skin incision Punch biopsy	Minimum size 4 mm x 12 mm Minimum size 5 mm	Sterile container without preservative	Makmal Kesihatan Awam Kebangsaan	12 – 18 months	Transport in ice Mycobacterium leprae Viability & Drug Sensitivity Test Request Form
Mycobacterium leprae PCR	Skin incision Punch biopsy	Minimum size 4 mm x 12 mm Minimum size 5 mm	Sterile container without preservative or in container with 70% ethanol (if collection >5 days)	Makmal Kesihatan Awam Kebangsaan	7 days	Transport in ice General PER PAT Form
Mycobacterium leprae LPA	Skin incision Punch biopsy	Minimum size 4 mm x 12 mm Minimum size 5 mm	Sterile container without preservative or in container with 70% ethanol (if collection >5 days)	Makmal Kesihatan Awam Kebangsaan	14 days	Sample in container with 70% ethanol can be stored for longer period of time before delivery to the laboratory General PER PAT Form

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
Mycobacterium tuberculosis PCR	Sputum Tissue CSF Pus Body fluids	Sputum: 3 - 5 ml CSF/ fluid/ pus: 1 - 2 ml	Sterile plain container	Makmal Kesihatan Awam Kebangsaan	7 working days	Borang Permohonan Ujian Tibi, KKM TBIS 20C
Nipah Virus Antibody	Serum Plasma CSF	1 - 3 ml 1 - 3 ml 1 - 3 ml	Plain tube EDTA tube Sterile container	Virology, NIH	1 – 10 days	Transport in ice Virology Test Request Form
Nipah Virus qRT-PCR	Serum	2 - 4 ml	Plain tube	Makmal Kesihatan Awam Kebangsaan	3 days	Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK
	CSF	1 - 3 ml	Leak-proof sterile container			
	Urine	10 ml (early morning first void)				
	Organ biopsy	1.5 cm^3 in few drops VTM				
	Throat/ oropharyngeal/ nasopharyngeal swab	-	Sterile container with 2.0 - 2.5 ml VTM			
Panel Anti Ganglioside Antibodies	Serum CSF	5 ml At least 1 ml	Plain tube Bijou bottle	Autoimmune, NIH	14 days	Autoimmune Request Form
Panel Anti Neutrophil Cytoplasmic Antibody (ANCA) – (P-ANCA, C-ANCA)	Serum	3 - 5 ml	Plain tube	Microbiology, H. Selayang	30 days	General PER-PAT Form
Panel Coeliac (Anti-Endomysium, Anti-Gliadin, Anti Tissue Transglutaminase)	Serum	5 ml	Plain tube	Autoimmune, AIRC NIH	21 days	Autoimmune Request Form
Panel Paraneoplastic Neurological Syndrome	Serum CSF	3 - 5 ml 1 ml	Plain tube Bijou bottle	Autoimmune, NIH	14 days	Autoimmune Request Form
Panel Tissue Auto-antibodies: (Anti-Gastric Parietal Cell Antibody (APC), Anti-Mitochondrial Antibodies (AMA), Anti-Smooth Muscle (ASMA), Anti-Liver Kidney Microsomal Ab (LKM)	Serum	3 - 5 ml	Plain tube	Microbiology, H. Selayang	30 days	General PER-PAT Form
Parvo Virus B19 qPCR	Serum CSF	3 ml 1 ml	Plain tube Sterile plain container	Makmal Kesihatan Awam Kebangsaan	3 days	Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK
Polio virus & Non-Polio Enterovirus	Stool	>5 g (thumb size)	Sterile plain container	Virology, NIH	14 days	Acute Flaccid Paralysis Case Investigation Form
Respiratory virus isolation and identification (Influenza Virus A and B, Adenovirus, Respiratory Syncytial Virus, Parainfluenza Virus 1, 2, and 3, Human Metapneumovirus)	Nasal aspirate/ Nasopharyngeal aspirate/ Sputum/ Tracheal aspirate/ Bronchoalveolar lavage	1 - 3ml	Leak-proof sterile container	Virology, NIH	14 – 28 days	Virology Test Request Form

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
	Nasopharyngeal swab/ Throat/ Tonsillar/ Oropharyngeal swab (OPS)	NA	Swab of VTM			
Rickettsia PCR (Aerobic Bacteria)	Blood Eschar biopsy/ swab	5 ml	EDTA tube VTM	Bacteriology, NIH	5 days	Rickettsiosis Laboratory Request Form
Rubella virus qRT PCR	Urine NPA/ Tracheal Aspirate Throat swab	10 ml 1 -3 ml	Sterile plain container VTM	Makmal Kesihatan Awam Kebangsaan	14 days	Measles-Borang Permohonan dan Keputusan Ujian Makmal
S.IgE (Specific Immunoglobin E)	Serum	3 ml	Plain tube	Allergy, AIRC NIH	10 days	Allergy Request Form
Schistosomiasis Serology	Serum	2 ml	Plain tube	Parasitology, NIH	5 days	To send sample in ice General PER PAT Request Form
T.IgE (Total Immunoglobulin E)	Serum	3 ml	Plain tube	Allergy, AIRC NIH	10 days	Allergy Request Form
Taeniasis/ Cysticercosis Serology	Serum Blood	2 ml 2 ml	Plain EDTA tube	Parasitology, NIH	5 days	General PER PAT Form
TBNK Enumeration (PID)	Blood	2 ml	EDTA tube	PID, NIH	5 days	By appointment only call 03-33628386/ 7412 Primary Immuno-deficiency (PID) Request Form
Viral Culture	CSF BAL NPA Vesicle fluid Stool Tissue	CSF/ BAL/ NPA: 1 – 3 ml Others: Not applicable	Sterile bottle	Makmal Kesihatan Awam Kebangsaan	4 – 6 weeks	General PER PAT Request Form
Zika virus qRT PCR	Serum CSF	2 - 4 ml 1 ml	Plain tube with serum separator Sterile screw capped container	Makmal Kesihatan Awam Kebangsaan	3 days	Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK

LIST OF REQUEST FORMS

Forms	Code	Description
Acute Flaccid Paralysis Case Investigation Lab Request Form	IMR/VIRO/TC56	IMR AFP Case
Allergy Request Form	IMR/AIRC/Allergy/RF	IMR
Autoimmune Request Form	IMR/AIRC/Autoimmune/RF	IMR
Bacteriology Request Form	IMR/BACT/FORM/SMIS/01	IMR
Bartonellosis Laboratory Request Form	IMR/BACT/FORMS/BART/01	IMR
Borang Permohonan Ujian Calitan Torehan Kulit Kusta	LIS102A	MKAK
Borang Permohonan Ujian Makmal HFMD	MKAK/ENT/20	MKAK
Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK	MKAK-BPU-U01/Rev2018	For MKAK viral identification
Borang Permohonan Ujian Tibi, KKM	TBIS 20C	All TB samples
Brucellosis Laboratory Request Form	IMR/IDRC/BACT/BRUCE/03	IMR
General PER-PAT Form	PER-PAT 301	For other tests
HIV Genotyping Resistance Testing	IMR/Viro/HIV/24	IMR
HLA Antibody Test Request Form (PRA/DSA)	IMR/AIRC/TI/RF-4	IMR
HLA Crossmatch Test Request Form (Living Donor)	IMR/AIRC/TI/RF-1	IMR
HLA Typing Test Request Form	IMR/AIRC/TI/RF-2	IMR
HLA Typing Test Request Form (Disease Association)	IMR/AIRC/TI/RF-3	IMR
Laboratory Request Form For Dengue and Flavivirus	MKAK-BPU-D02 (rev_Nov_2015)	MKAK
Leptospirosis Laboratory Request Form	IMR/IDRC/BACT/LEPTO/01	IMR
Malaysia Influenza (ILI to MKAK Sg Buloh/ SARI to Virology Unit, NIHS)	IMR/RES/20	IMR
Measles Borang Permohonan Dan Keputusan Ujian Makmal	MSLF:01/2004	MKAK
Mycobacterium leprae Viability and Drug Sensitivity Test Request Form	MKAK-BPU-K03	MKAK
Mycology Request Form	IMR/IDRC/BACT/MYCO/01	IMR
Primary Immunodeficiency (PID) Request Form	IMR/AIRC/PID/RF	IMR
Rickettsiosis Laboratory Request Form	IMR/BACT/FORMS/RICK/02	IMR
TB NGS Laboratory Request Form	IMR/IDRC/BACT/TBNGS/01	IMR
Tuberculosis Laboratory Request Form	IMR/IDRC/BACT/TB/01	IMR
Ujian PCR Untuk HIV Di Kalangan Bayi	IMR/Viro/HIV/2 IMR/VIRUS/NAR L2	IMR
Virology Test Request Form	IMR/VIRO/ADMIN/53	IMR

All request forms can be downloaded via the hyperlinks or from Public Folder > Borang-Borang > Borang Pathology > Borang Unit Mikrobiologi

ANATOMIC PATHOLOGY

INTRODUCTION

All histopathology and cytology samples are referred to referral laboratories.

HISTOPATHOLOGY EXAMINATION (HPE)

List of Services

i. Surgically and non-surgically removed tissue
ii. Frozen section

General Procedure for Submission of Sample

i. Put the sample in a suitable leak-proof container. **DO NOT** put large sample in small containers as this would prevent proper fixation of the tissue and distort the sample.
ii. Fix the samples in 10% formalin. The volume of formalin used is at least 10 times of the sample.
iii. Seal the container securely to avoid leakage and pack with proper plastic to avoid damage during transport.
iv. Ensure the same patient identification are written on the request forms (3 copies of PER-PAT 301 forms) and on the sample.
v. Every sample must be accompanied by a completed request form giving full particulars of the patient including relevant clinical history, diagnosis and previous histopathology reports, if any. Clearly indicates the ward/ clinic where the sample was taken. Also, include name of doctor in charge (especially the surgeon in charge), for contact if there is any inquiry.
vi. Stick the barcode at the right-hand side corner of all 3 copies of the PER-PAT 301 forms. For urgent request, please mark as "**URGENT**" on the request form.

Sample Collection and Preparation

i. For adequacy of surgical excision in malignant neoplasm, the margins must be marked accordingly by sutures or by diagrammatic representation of the excised sample.
ii. Send fresh sample for immunofluorescence (IMF) and enzyme histochemistry studies in a container containing phosphate buffered saline (PBS) to prevent drying.
iii. IMF samples received after office hour will be kept at 2-8°C and sent to referral laboratories during next working day.
iv. Samples are sent to the referral laboratories daily except on Saturday, Sunday and public holiday.

Frozen Section

i. The tissues for frozen section are to be sent fresh without formalin or in gauze moistened with normal saline to prevent drying.
ii. Frozen section can only be requested by the specialist treating the patient by making an appointment with the histopathology's on-call (Hospital UiTM Sungai Buloh or Hospital Selayang) and pathology laboratory (ext. 2122, MO Outsource) at least 24-48 hours prior to sample collection.
iii. All cases scheduled for frozen section examination are best placed first in the operating list. No frozen sections are available after office hours.
iv. Please inform the laboratory when:
    a. The patient is wheeled into the operating room
    b. The frozen section specimen is on the way to the laboratory
    c. The frozen section examination is cancelled
v. The requester must send the sample immediately to the laboratory with the request form. Transport will be arranged by the laboratory and the laboratory's PPK will send the sample to referral laboratory.

CYTOLOGY EXAMINATION

List of Services

i. Exfoliative cytopathology: involves examination of specimens which contain exfoliated cells. The usual specimens received are cervical smears, sputum, urine, pleural fluid, peritoneal fluid and washings of various sites.
   a. Gynaecologic: pap smear
   b. Non gynaecologic: sputum, urine, body fluids, vesicle fluid
ii. Aspiration cytopathology: involves examination of cells that are obtained by fine needle aspiration and brushings.
   a. Fine needle aspiration
   b. Brushings

General Procedure for Submission of Sample

i. Samples for cytological examination should be put in clean universal leak-proof containers.
ii. Samples should have the same identification as that written on the request forms.
iii. The form must be completely filled including the clinical history to avoid rejection.
iv. Samples should be sent immediately to the laboratory to be sent to referral laboratory.
v. Samples collected after office hours will be kept at 2-8°C to preserve the cell before being sent to the referral laboratory the next working day.
vi. **DO NOT FREEZE THE SAMPLES.**

Sample Collection and Preparation

A. Pap smear
   i. Insert the cervical broom into the endo-cervical canal. Apply gentle pressure while turning clockwise direction until the bristles are bend against the cervix. Maintaining the gentle pressure, rotate the broom for 5 times in clockwise direction.
   ii. Transfer the sample into the PathTezt solution vial by disconnecting the broom from the stem.
   iii. Cap and label the vial.
   iv. Send the vial to the laboratory.

B. Sputum
   i. Specimen must be collected on three consecutive days.
   ii. Instruct the patient to empty the mouth of all saliva immediately after waking up in the morning.
   iii. The patient should then cough deeply and collect the sputum in the container supplied.
   iv. Send the sample immediately to the laboratory and do not forget to collect similar sample on the next two days.
   v. The sample container should be labelled according to the day specimen is collected.

C. Urine
   i. The patient should void and discard the first morning specimen. Do not send overnight urine sample as most of the cells in this sample are degenerated.
   ii. Collect the next voided urine and send it immediately to the laboratory.

D. Body fluid (pleural fluid, ascitic fluid, cerebrospinal fluid, pericardial fluid, etc)
   i. Collect samples in clean containers and send immediately to the laboratory.

E. Vesicle fluid
   i. Prepare two thin smears on clean glass slides.
   ii. Air-dry the slides. Air- drying is done by putting the slide in a vertical position on a slide rack or placed horizontally on a table top and letting the smear dry. This usually takes 10 minutes to 15 minutes.
   iii. Place the slides in a slide mailer and send to the laboratory for Giemsa staining.

F. Fine Needle Aspiration Cytology (FNAC)

i. FNAC is conducted twice a week at the surgical outpatient department (SOPD) clinic and once a week at the ENT clinic.

Tuesday and Thursday	:	9.00 am (SOPD)
Tuesday	:	2.00 pm (ENT)
Wednesday	:	9.00 am (Radiology)

ii. Appointment requests for FNAC should be ordered only by the medical officer or specialist. The request forms should be filled legibly, complete with the clinical history and findings. Whenever there is more than one lump or swelling present, the clinician should indicate which lump/s or swelling/s to be aspirated. The clinician requesting the FNAC procedure should have his/her name clearly written on the request form so that they would be able to be contacted if there is any query.

iii. Indications for FNAC:

- Breast cancer cases to confirm diagnosis
- Suspicious lesions to exclude breast cancer
- Solitary cold nodule in a thyroid gland
- Suspicious lesions such as salivary gland tumours and subcutaneous nodules

iv. Please note that:

- Breast and thyroid cyst may be aspirated by the surgeon and material sent for cytologic examination
- There is no indication for FNAC in multinodular goitre or diffuse goitre
- Vascular lesions or those of vascular origin should not be sent for FNAC
- Radiologist under radiological guidance on appointment basis performs FNAC for deep-seated lesions

TRACING OF REPORTS

Click **View Image** to view full HPE report attachment.