

Pathology Services Handbook 2025

Hospital Sungai Buloh



HOSPITAL SUNGAI BULOH PATHOLOGY SERVICES HANDBOOK

9th Edition, 2025

Advisor

Dr. Sahlawati Hj Mustakim
Dr. Nor Adilah Abdul Rahman

Editor

Aminatul Alisya Ahmad Saifuddin

Contributors

Anatomic Pathology;
Dr. Noor Haslinda Azlin Abd Halim

Chemical Pathology;
Dr. Sharifah Khairul Atikah Syed Kamarudin
Rozita Abdullah
Aminatul Alisya Ahmad Saifuddin

Haematology;
Dr. Firdaus Mashuri

Medical Microbiology;
Dr. Nur Hanani Ahmad
Dr. Aisyah Abdullah

Transfusion Medicine;
Dr. Sarojini Maniam
Dr. Nusaibah Wan Zulkipli
Dr. Nur Fatin Shazwani Rembly

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.



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 ninth edition of its Pathology Services Handbook 2025. 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



It is with great pride and commitment that we present the **Hospital Sungai Buloh Pathology Services Handbook, Ninth Edition 2025**, 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 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	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 <i>*except for urgent molecular, transplants and needle stick injury cases</i>	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

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 influence 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* <i>*To call MO Microbiology/ Clinical Microbiologist on-call for urgent requests</i>
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 <i>*To call MO Blood Bank on duty for codes</i>

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
Pathology Laboratory, Hospital Kuala Lumpur	Daily
Pathology Laboratory, Hospital Tunku Azizah	Daily
Pathology Laboratory, Hospital Selayang	Daily
Pathology Laboratory, Hospital UITM	Daily
Makmal Kesihatan Awam Kebangsaan, Sungai Buloh	Daily
Pusat Darah Negara	Daily
Institute for Medical Research, Jalan Pahang, Kuala Lumpur	Daily
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.

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

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

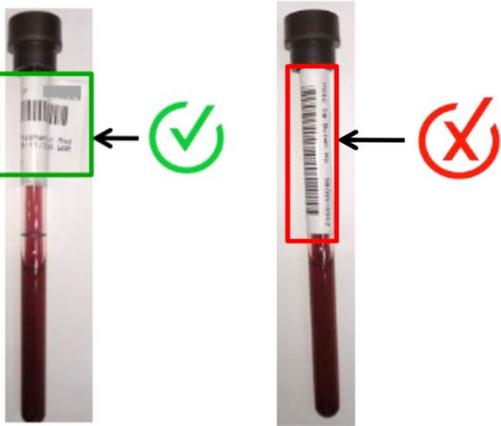
Tube/ Container	Sample/ Tube Description	Common Use	Special Instruction
<p>Adult</p>  <p>Paediatric</p> 	<p>Plasma</p> <p>Sodium Fluoride</p>	<p>Chemical Pathology: Glucose testing</p>	<p>Mix well gently</p>
	<p>Plasma</p> <p>3.2% Sodium Citrate</p>	<p>Haematology: PT, APTT, D-Dimer, fibrinogen, mixing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

Tube/ Container	Sample/ Tube Description	Common Use	Special Instruction
	Sterile urine container/ universal container	<p>Chemical Pathology: Urine and other body fluid biochemistry</p> <p>Medical Microbiology: Urine, body fluid tissue, implant (small device such as screw) for culture & sensitivity</p> <p>Haematology: Trephine biopsy</p> <p>Transfusion Medicine: Transfusion reaction workup</p> <p>Histopathology: Small biopsy (add 10% formalin)</p> <p>Cytology: FNAC specimen</p>	<p>Ensure cap is tight to prevent specimen leakage</p> <p>Do not add formalin for tissue culture and cytology specimen</p>
	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 <i>Clostridium difficile</i> 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
<p>Adult</p>  <p>Paediatric</p> 	<p>Blood culture bottle (aerobic/ anaerobic)</p>	<p>Medical Microbiology: Blood culture</p> <p>Transfusion Medicine: Transfusion reaction workup (for blood bag only)</p>	<p>Mix with swirling method</p> <p>Do not store in the refrigerator</p>

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
<p>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.</p>	
<p>Barcode pasted horizontally or slanted</p>	
<p>Barcode pasted on the cap</p>	
<p>Overlapped barcode</p>	
<p>Barcode pasted on the blood culture bottle's barcode</p>	

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

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.

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

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

1 How to search laboratory result at Clinical Event History

1. Open Patient chart

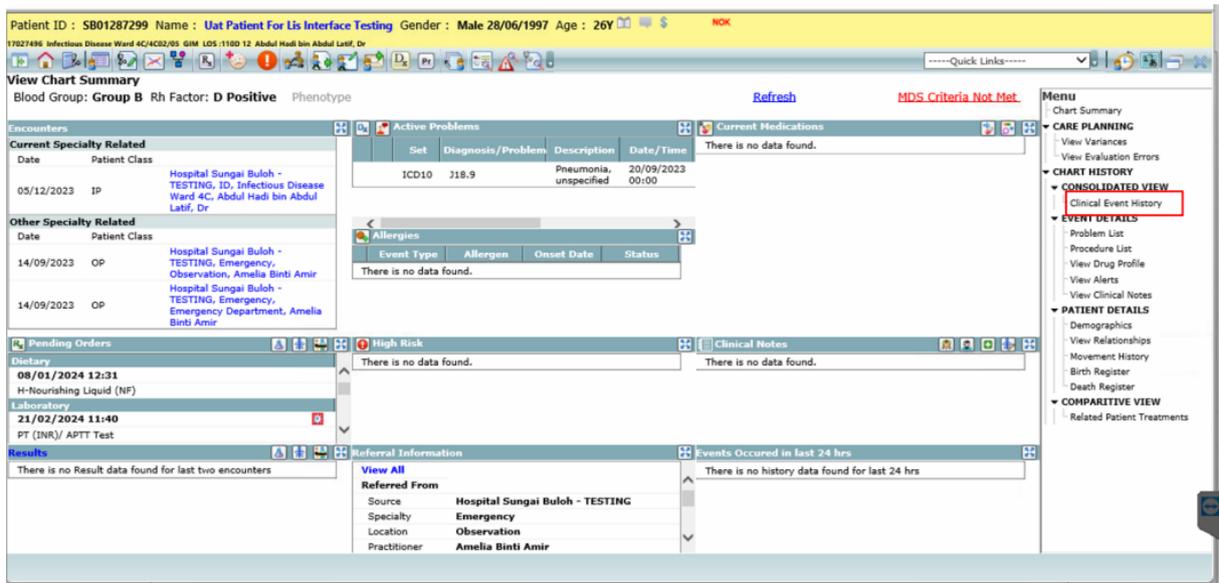
The screenshot displays a patient chart for 'Uat Patient For Lis Interface Testing' (Male, 28/06/1997, Age 26Y). The interface includes several panels:

- View Chart Summary:** Blood Group: Group B, Rh Factor: D Positive, Phenotype. Includes a 'Refresh' button and 'MDS Criteria Not Met' status.
- Encounters:** A table with columns for Date, Patient Class, and location. One encounter is listed for 05/12/2023 at Hospital Sungai Buloh - TESTING, ID, Infectious Disease Ward 4C, Abdul Hadi bin Abdul Latif, Dr.
- Other Specialty Related:** A table with columns for Date, Patient Class, and location. Two encounters are listed for 14/09/2023 at Hospital Sungai Buloh - TESTING, Emergency, Observation, Amelia Binti Amir.
- Active Problems:** A table with columns for Set, Diagnosis/Problem, Description, Date/Time, and Diagnosis. One problem is listed: ICD10 J18.9 Pneumonia, unspecified, 20/09/2023 00:00.
- Current Medications:** A table with the message 'There is no data found.'
- Allergies:** A table with the message 'There is no data found.'
- Pending Orders:** A table with columns for Date, Time, and description. Two orders are listed: 08/01/2024 12:31 H-Nourishing Liquid (NF) and 21/02/2024 11:40 PT (INR)/ APTT Test.
- High Risk:** A table with the message 'There is no data found.'
- Clinical Notes:** A table with the message 'There is no data found.'
- Results:** A table with the message 'There is no Result data found for last two encounters.'
- Referral Information:** A table with columns for Referred From, Source, Specialty, Location, and Practitioner. The information is: Referred From: Hospital Sungai Buloh - TESTING, Source: Emergency, Location: Observation, Practitioner: Amelia Binti Amir.
- Events Occurred in last 24 hrs:** A table with the message 'There is no history data found for last 24 hrs.'

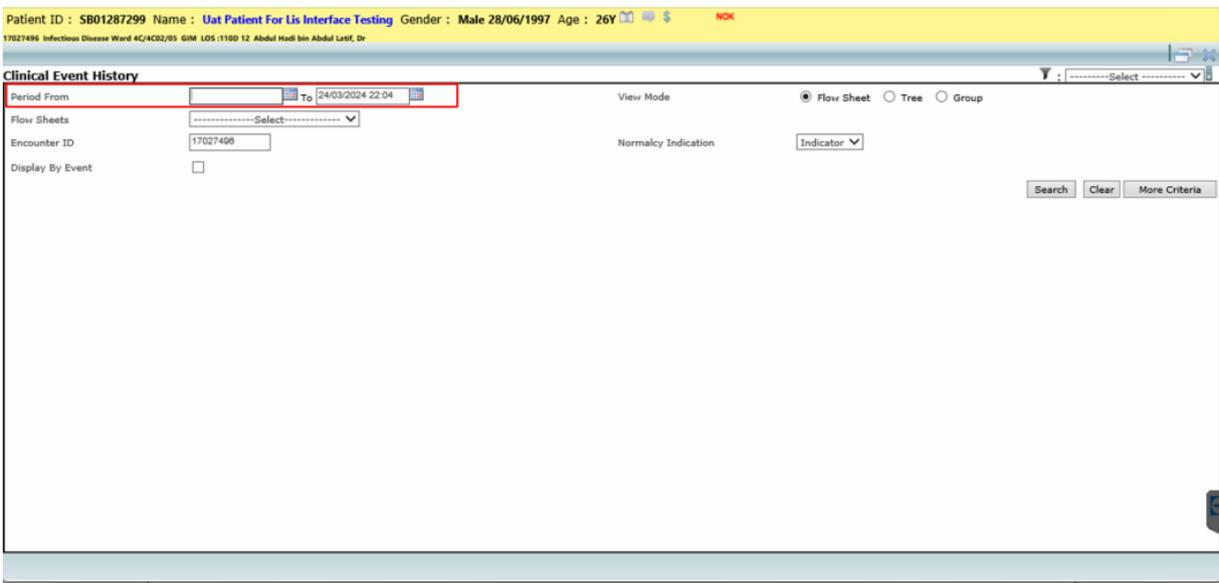
2. At the right corner, click this icon

This screenshot is identical to the one above, but with a red box highlighting a magnifying glass icon in the top right corner of the interface, indicating the search function.

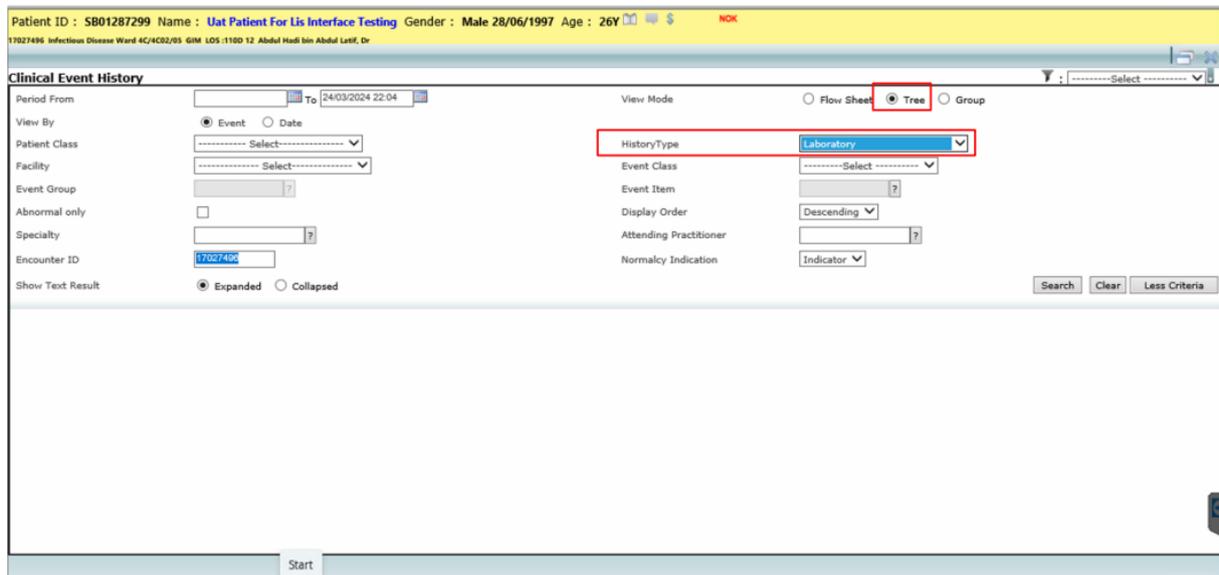
3. Select Clinical Event History



4. Remove date at Period From



5. View Mode = Tree, History Type = Laboratory



6. Clear data at Encounter ID

The screenshot shows the 'Clinical Event History' interface for a patient with ID SB01287299. The patient's name is 'Uat Patient For Lis Interface Testing', gender is 'Male', and age is '26Y'. The interface includes various filters and controls:

- Period From:** 24/03/2024 22:04
- View By:** Event (selected), Date
- View Mode:** Flow Sheet, Tree (selected), Group
- HistoryType:** Laboratory
- Event Class:** Select
- Event Item:** ?
- Display Order:** Descending
- Attending Practitioner:** ?
- Normalcy Indication:** Indicator
- Encounter ID:** (highlighted with a red box)
- Show Text Result:** Expanded (selected), Collapsed

Buttons for 'Search', 'Clear', and 'Less Criteria' are visible at the bottom right. The status bar at the bottom indicates '27°C Mostly cloudy'.

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

The screenshot shows the 'Clinical Event History' interface with search results displayed. The 'View By' filter is set to 'Date'. The results are sorted by date, showing tests performed on 03/06/2025 and 10/04/2025.

Date	Test Name	Result
03/06/2025	(CRE Confirmation)-OXA-48 Gene	Not Applicable Specimen Type: Isolate (Blood agar / Nutrient Slant) Specimen No: 302500093 Category No: 1
03/06/2025	(CRE Confirmation)-NDM-1 Gene	Not Applicable Specimen Type: Isolate (Blood agar / Nutrient Slant) Specimen No: 302500093 Category No: 1
10/04/2025	(CRE Confirmation)-KPC Gene	Not Detected Specimen Type: Isolate (Blood agar / Nutrient Slant) Specimen No: 302500093 Category No: 1
10/04/2025	(CRE Confirmation)-VIM Gene	Not Detected Specimen Type: Isolate (Blood agar / Nutrient Slant) Specimen No: 302500093 Category No: 1
10/04/2025	(CRE Confirmation)-IMP Gene	Not Detected Specimen Type: Isolate (Blood agar / Nutrient Slant) Specimen No: 302500093 Category No: 1

At the bottom, there are buttons for 'Copy Text', 'Manage', 'Comments', 'Print', 'Email', and 'View'. The status bar shows 'High', 'Low', 'Abnormal', 'Critical', 'Critical Low', 'Critical High', and 'Normal' indicators.

➤ View by Event

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

Patient ID : 5801287299 **Name :** Uat Patient For Lia Interface Testing **Gender :** Male **Age :** 27Y **MRN :** 17027496 Infection Disease Ward 4C/ICM413 GIM LOS:568D 12 Abdu Hadi bin Abdul Latif Dr

Clinical Event History Laboratory

Period From: [] To: 23/06/2025 22:02 View Mode: Flow Sheet Tree Group

View By: Event Date Normalcy Indication: Indicator: [v]

Encounter ID: [] Show Test Result: Expanded Collapsed

Search [] Clear [] More Criteria []

History

- ▶ Hospital Sungai Buloh - TESTS
 - ▶ Blood Transfusion/Transfer
 - ▶ Laboratory
 - ▶ **ETS**
 - ▶ Clinical History
 - ▶ ABO Group (Direct Only)
 - ▶ ABO & Rh Grouping
 - ▶ Antibody Screening
 - ▶ ANS
 - ▶ GDM for Transfusion Rx
 - ▶ Haemoglobin, Urine (Rk)
 - ▶ Test Method :
 - ▶ **UPEM**
 - ▶ **Chem Path**
 - ▶ Ammonia
 - ▶ Ammonia Critical Value
 - ▶ Amylase
 - ▶ Calcium
 - ▶ Calcium Critical Value
 - ▶ Creatinine
 - ▶ eGFR
 - ▶ Lipid Profile
 - ▶ Glucose Random
 - ▶ HBA1C Group
 - ▶ LDL Cholesterol
 - ▶ **Histopathology**
 - ▶ Clinical History
 - ▶ SIP Appendix (Big Speech)
 - ▶ SIP Histology

Blood Transfusion/Transfer

(Red Blood Cells)- Red Blood Cells Unit : BCP05000001, Blood Group/Rhous : B/DPOS, Volume : 200 ML, Transfused Volume : 200 ML, Date : 05/06/2024 10:39, Reaction : No Adverse Reaction

05/06/2024 10:39

13/05/2024 16:15 Unit : TEST000546, Blood Group/Rhous : B/DPOS, Volume : 200 ML, Transfused Volume : 200 ML, Date : 13/05/2024 16:15, Reaction : Chills

Transfusion Adverse Reaction Comment : Febrile Non Hemolytic Transfusion Reaction.
Suggestion : Red cells should be transfused within 30 minutes of removal from the blood refrigerator. The transfusion of each unit of red cells shall not exceed 4 hours from removal from the blood refrigerator.

Laboratory

Clinical History Performing Location: Unit Blokimia, IIR Kuala Lumpur

04/01/2024 11:52 Specimen No : 4024000016

Category No :

Blood Transfusion/Transfer

(Red Blood Cells)- Red Blood Cells Unit : 0302812009, Blood Group/Rhous : O/DPOS, Volume : 200 ML, Transfused Volume : 200 ML, Date : 04/01/2024 11:46, Reaction : Chills

04/01/2024 11:46

Click on value cell to deselect/select and Perform ==>

Copy Text [] Manage [] Comments [] Print [] Email [] View [] H 4 | Page 1 of 67

High [] Low [] Abnormal [] Critical [] Critical Low [] Critical High [] Normal []

Performed By : Hoshafira Bt Othman Encounter : P.17027496 Visit/Admission Date/Time:05/12/2023 09:10 Medical Service : GIM Attending Physician: Abdu Hadi bin Abdul Latif Dr

CRITICAL RESULTS NOTIFICATION

All critical results shall be notified to respective ward or clinic once the results are 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:

- Biological variation within individuals
- Analytical measurement imprecision
- 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	LTAT	Reference Interval	Remarks
Acetaminophen	Plain tube	Urgent: 90 minutes Routine: 4 hours	Normal therapeutic range: 10-30 ug/mL <i>Conversion factors:</i> $\mu\text{g/mL} \times 6.62 = \mu\text{mol/L}$ $\mu\text{g/mL} \times 1.0 = \text{mg/L}$	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	Urgent: 4 hours Routine: 6 hours	Males: 10-50 U/L Females: 10-35 U/L	
Albumin, serum	Plain tube	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	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	Urgent: 4 hours	Adults Males: 40-129 U/L	

Test	Sample Container	LTAT	Reference Interval	Remarks
		Routine: 6 hours	Females: 35-104 U/L Children (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	
Alpha Fetoprotein (AFP)	Plain tube	5 working days	≤7.0 ng/mL	Run every Tuesday & Thursday Interval between order is 3 months. Please call Pathology MO/Specialist if indicated.
Ammonia	EDTA tube	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	Urgent: 4 hours Routine: 6 hours	28-100 U/L	
Amylase, urine (Diastase)	Sterile container	6 hours	Males: 16-491 U/L Females: 21-447 U/L	
Anti-streptolysin 'O' Titre (ASOT)	Plain tube	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	Urgent: 4 hours	Males: 10-50 U/L	

Test	Sample Container	LTAT	Reference Interval	Remarks
		Routine: 6 hours	Females: 10-35 U/L	
Beta HCG (Quantitative)	Plain tube	Urgent: 90 minutes Routine: 4 hours	Non-pregnant premenopausal women: <1 mIU/mL Post-menopausal women: <7 mIU/mL Men: <2 mIU/mL	
Bilirubin, Direct	Plain tube	Urgent: 4 hours Routine: 6 hours	≤3.4 µmol/L	
Bilirubin, Total	Plain tube	Urgent: 4 hours Routine: 6 hours	Adults Males: ≤24 µmol/L Females: ≤15 µmol/L Children (4 days-1 month): ≤17 µmol/L Newborn (24 hours): ≥137 µmol/L (48 hours): ≥222 µmol/L (84 hours): ≥290 µmol/L	
Body Fluid Biochemistry • Glucose • LDH • Protein	Sterile container	1 working day	Methodology of analysis for body fluid is not validated. Thus, reference range is not available.	
C-reactive Protein (CRP)	Plain tube	6 hours	Adults: <0.5 mg/dL	Interval between order is 24 hours. Please call Pathology MO/Specialist if indicated.
Calcium	Plain tube	Urgent: 4 hours Routine: 6 hours	Children (0-10 days): 1.90-2.60 mmol/L (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	

Test	Sample Container	LTAT	Reference Interval	Remarks
			(18-60 years): 2.15-2.50 mmol/L Adults (60-90 years): 2.20-2.55 mmol/L (>90 years): 2.05-2.40 mmol/L	
Calcium, urine	Sterile container/ 24hr urine container	1 working day	24-hour: 2.5-7.5 mmol/day	With normal food intake
Cancer Antigen (CA 19-9)	Plain tube	5 working days	<27 U/mL	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. Run every Tuesday & Thursday
Cancer Antigen (CA 125)	Plain tube	5 working days	<35 U/mL	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. Run every Tuesday & Thursday
Carbamazepine	Plain tube	Urgent: 1 day Routine: 3 days	Therapeutic range 16.9-50.8 µmol/L	Peak concentrations above 50.8 µmol/L are often associated with toxicity
Carcinoembryonic Antigen (CEA)	Plain tube	5 working days	<5.2 ng/mL	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. Run every Tuesday & Thursday
Chloride, serum	Plain tube	Urgent: 4 hours Routine: 6 hours	98-107 mmol/L	
Chloride, urine	Sterile container/ 24hr urine container	1 working day	24-hour: 110-250 mmol/day	
Cholesterol	Plain tube	6 hours	<5.2 mmol/L	Reference: Malaysian Clinical Practice Guidelines Management of Dyslipidaemia 2023
Cholesterol, HDL	Plain tube	6 hours	Males: >1.0 mmol/L	Reference:

Test	Sample Container	LTAT	Reference Interval	Remarks														
			Females: >1.2 mmol/L	Malaysian Clinical Practice Guidelines Management of Dyslipidaemia 2023														
Cholesterol, LDL	-	6 hours		<table border="1"> <thead> <tr> <th colspan="2">Target LDL-C Levels</th> </tr> <tr> <th>Global Risk</th> <th>Target LDL-C Levels (mmol/L)</th> </tr> </thead> <tbody> <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⁻¹/1.73m²</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⁻¹/1.73m²</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> </tbody> </table> <p>Reference: Malaysian Clinical Practice Guidelines Management of Dyslipidaemia 2023</p>	Target LDL-C Levels		Global Risk	Target LDL-C Levels (mmol/L)	Low CV Risk <10% 10-year CVD risk	< 3.0	Intermediate (Moderate) CV Risk • 10-20% 10-year CVD risk • Diabetic <50 years old and <10-year duration and no CV risk factors	< 2.6	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	≤ 1.8 and a reduction of >50% from baseline	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	≤ 1.4 and a reduction of >50% from baseline	Those with recurrent CV events within 2 years despite achieving LDL-C target of <1.4 mmol/l	< 1.0
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Cholesterol, non-HDL	-	6 hours		<table border="1"> <thead> <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> </thead> <tbody> <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⁻¹/1.73m²</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⁻¹/1.73m²</td> <td>≤ 2.2 and a reduction of >50% from baseline</td> </tr> </tbody> </table> <p>Reference: Malaysian Clinical Practice Guidelines Management of Dyslipidaemia 2023</p>	Target Non-HDL-C Levels		Global Risk	Target Non-HDL-C Levels (mmol/L)	Low CV Risk <10% 10-year CVD risk	< 3.8	Intermediate (Moderate) CV Risk • 10-20% 10-year CVD risk • Diabetic <50 years old and <10-year duration and no CV risk factors	< 3.4	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	≤ 2.6 and a reduction of >50% from baseline	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	≤ 2.2 and a reduction of >50% from baseline		
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Complement C3	Plain tube	1 working day	0.9-1.8 g/L															
Complement C4	Plain tube	1 working day	0.1-0.4 g/L															
Cortisol, salivary	Salivette® oral fluid collection device *External users to provide their own Salivette® device	5 working days	Morning (6-10 am): 2.1-22.6 nmol/L Midnight (11-12 am): <12.0 nmol/L	Analysis on Monday only Form: PER-PAT 301 Must be stamped and signed by Endocrinologist Reference: Malays J Pathol 2020; 42(3): 433-437														

Test	Sample Container	LTAT	Reference Interval	Remarks																					
Cortisol, serum	Plain tube	1 working day	Morning hours (6-10 am): 133-537 nmol/L Afternoon hours (4-8 pm): 68.2-327 nmol/L																						
Cortisol, urine	24hr urine container	1 working day	24-hour urine: 31.7-282 nmol/day																						
Creatine Kinase (CK)	Plain tube	6 hours	Males: 39-308 U/L Females: 26-192 U/L																						
Creatinine, serum	Plain tube	Urgent: 4 hours Routine: 6 hours	Males: 62-106 µmol/L Females: 44-80 µmol/L																						
Creatinine, urine	Sterile container/ 24hr urine container	1 working day	Random Males: 3450-22900 umol/L Females: 2470-19200 umol/L 24-hour Males: 9000-21000 umol/day Females: 7000-14000 umol/day																						
CSF Biochemistry • Glucose • Protein	Bijou bottle/ Sterile container	Urgent: 90 minutes Routine: 4 hours	Glucose Adults: 2.22-3.89 mmol/L Children: 3.33-4.44 mmol/L Protein 0.15-0.45 g/L	Send immediately to lab																					
eGFR	-	6 hours	Stages of CKD (KDIGO) <table border="1"> <thead> <tr> <th>Stage</th> <th>GFR (ml/min/ 1.732 m²)</th> <th>Terms</th> </tr> </thead> <tbody> <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> </tbody> </table>	Stage	GFR (ml/min/ 1.732 m ²)	Terms	G1	≥90	Normal or high	G2	60-89	Mildly decreased	G3a	45-59	Mildly to moderately decreased	G3b	30-44	Mildly to moderately decreased	G4	15-29	Severely decreased	G5	<15	Kidney failure	
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G3a	45-59	Mildly to moderately decreased																							
G3b	30-44	Mildly to moderately decreased																							
G4	15-29	Severely decreased																							
G5	<15	Kidney failure																							

Test	Sample Container	LTAT	Reference Interval	Remarks
			<p>eGFR must be interpreted 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)</p> <p>Ref: MACB 2024 Recommendation for the Laboratory Reporting of eGFR & Urine Albumin</p>	
Estradiol	Plain tube	7 working days	<p>Healthy men: 41.4-159 pmol/L</p> <p>Healthy post-menopausal women: <18.4-505 pmol/L</p> <p>Healthy pregnant women: 1st trimester: 563-11902 pmol/L</p> <p>2nd trimester: 5729-78098 pmol/L</p> <p>3rd trimester: 31287 - >110100 pmol/L</p> <p>Healthy women: Follicular: 114-332 pmol/L</p> <p>Ovulation: 222-1959 pmol/L</p> <p>Luteal: 222-854 pmol/L</p>	<p>Interval between order is 3 months. Please call Pathology MO/Specialist if indicated.</p> <p>Run every Tuesday</p>
Ferritin	Plain tube	3 working days	<p>Males: 30-400 ng/mL</p> <p>Females: 13-150 ng/mL</p>	
Folate	Plain tube	5 working days	<p>Males: 10.2-73.0 nmol/L</p> <p>Females: 10.9-84.5 nmol/L</p> <p>Both: (4-11 years): 19.5-85.4 nmol/L</p> <p>(12-19 years): 11.3-61.6 nmol/L</p>	<p>Interval between order is 3 months. Please call Pathology MO/Specialist if indicated.</p> <p>Run every Wednesday & Friday</p>

Test	Sample Container	LTAT	Reference Interval	Remarks
Follicle-Stimulating Hormone (FSH)	Plain tube	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. Run every Tuesday
Free T3 (Tri-iodothyronine)	Plain tube	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 11-20 years: 3.10-4.89 pmol/L Adult: 3.1-6.8 pmol/L	Test order by Specialist only
Free T4, neonate	Plain tube	1 working day	>15 pmol/L	
Free T4 (Thyroxine)	Plain tube	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	

Test	Sample Container	LTAT	Reference Interval	Remarks															
Free T4, Pregnancy	Plain tube	1 working day	1st trimester (6-12 weeks): 9.0-19.1 pmol/L 2nd trimester (13-27 weeks): 8.6-16.8 pmol/L 3rd trimester (28-40 weeks): 8.3-17.5 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.															
Gentamicin	Plain tube	Urgent: 1 day Routine: 3 days	Peak: 12.5-20.9 µmol/L Trough: 1.0-4.2 µmol/L	Conversion factors: ug/mL x 2.09 = umol/L ug/mL x 1.0 = mg/L															
Glucose, fasting			Normal: <6.1 mmol/L Prediabetes/IFG: 6.1- 6.9 mmol/L Diabetes: ≥7.0 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 (6 th edition) 2022															
Glucose, random	Fluoride Oxalate	6 hours	Normal: <7.8 mmol/L Impaired glucose tolerance: 7.8-11.0 mmol/L Diabetes: >11.1 mmol/L	Fasting glucose and random glucose cannot be ordered together Reference: Management of Type 2 Diabetes Mellitus (6 th edition) 2022															
Oral Glucose Tolerance Test (OGTT)	Fluoride Oxalate	6 hours	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 <table border="1"> <thead> <tr> <th>Category</th> <th>0-hour</th> <th>2-hour</th> </tr> </thead> <tbody> <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> </tbody> </table>	Category	0-hour	2-hour	Normal	<6.1	<7.8	IFG	6.1-6.9	-	IGT	-	7.8-11.0	T2DM	≥7.0	≥11.1	
Category	0-hour	2-hour																	
Normal	<6.1	<7.8																	
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IGT	-	7.8-11.0																	
T2DM	≥7.0	≥11.1																	
			Reference: Management of Type 2 Diabetes Mellitus (6 th edition) 2022																

Test	Sample Container	LTAT	Reference Interval	Remarks
Haemoglobin A1c (HbA1c)	EDTA tube	3 working days	<p>Normal: <5.6% (<38 mmol/mol)</p> <p>Pre diabetes: 5.7-6.2% (38-44 mmol/mol)</p> <p>Diabetes: >6.3% (>45 mmol/mol)</p>	<p>Interval between order is 3 months. Please call Pathology MO/Specialist if indicated</p> <p>Run on working days only</p>
High sensitive Troponin T	Plain tube	<p>Urgent: 90 minutes</p> <p>Routine: 4 hours</p>	<14 pg/mL	
Iron	Plain tube	3 working days	Adults: 5.83-34.5 µmol/L	
Lactate Dehydrogenase (LDH)	Plain tube	<p>Urgent: 4 hours</p> <p>Routine: 6 hours</p>	<p>Adults: 135-225 U/L</p> <p>Children (2-15 years): 120-300 U/L</p> <p>Newborns (4-20 days): 225-600 U/L</p>	
Luteinizing Hormone (LH)	Plain tube	7 working days	<p>Men: 1.7-8.6 U/L</p> <p>Healthy women: Follicular: 2.4-12.6 U/L</p> <p>Ovulation: 14.0-95.6 U/L</p> <p>Luteal: 1.0-11.4 U/L</p> <p>Postmenopause: 7.7-58.5 U/L</p>	<p>Interval between order is 3 months. Please call Pathology MO/Specialist if indicated.</p> <p>Run every Tuesday</p>
Magnesium, serum	Plain tube	<p>Urgent: 4 hours</p> <p>Routine: 6 hours</p>	<p>Newborns: 0.62-0.91 mmol/L</p> <p>5 months-6 years: 0.70-0.95 mmol/L</p> <p>6-12 years: 0.70-0.86 mmol/L</p> <p>12-20 years: 0.70-0.91 mmol/L</p>	

Test	Sample Container	LTAT	Reference Interval	Remarks
			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/ 24hr urine container	1 working day	24-hour: 3.0-5.0 mmol/day	
Osmolality, serum	Plain tube	1 working day	270-295 mOsm/kg	
Osmolality, urine	Sterile container	1 working day	300-900 mOsm/kg	
Paraquat, urine	Sterile container	90 minutes	Negative	
Phenytoin	Plain tube	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
Phosphate, serum	Plain tube	Urgent: 4 hours Routine: 6 hours	0.81-1.45 mmol/L	
Phosphate, urine	Sterile container/ 24hr urine container	1 working day	Random: 13-44 mmol/L 24-hour: 13-42 mmol/day	
Potassium, serum	Plain tube	Urgent: 4 hours Routine: 6 hours	3.5-5.1 mmol/L	
Potassium, urine	Sterile container/ 24hr urine container	1 working day	24-hour: 25-125 mmol/day	
Procalcitonin (PCT)	Plain tube	1 working day	<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	7 working days	Healthy men: 0.442-0.614 nmol/L Healthy post-menopausal women: 0.343-0.480 nmol/L	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. Run every Tuesday

Test	Sample Container	LTAT	Reference Interval	Remarks
			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	
Prolactin	Plain tube	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. Run every Tuesday
Prostate Specific Antigen (PSA), total	Plain tube	5 working days	<4 ng/mL	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. Run every Tuesday & Thursday
Rheumatoid Factor	Plain tube	1 working day	<14 IU/mL	
Salicylate	Plain tube	Urgent: 90 minutes Routine: 4 hours	Toxic range: >300 mg/L	
Sodium, serum	Plain tube	Urgent: 4 hours Routine: 6 hours	136-145 mmol/L	
Sodium, urine	Sterile container/ 24hr urine container	1 working day	24-hour: 40-220 mmol/day	
Testosterone	Plain tube	7 working days	Males: (20-49 years): 8.64-29.0 nmol/L (≥50 years): 6.68-25.7 nmol/L	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. Run every Tuesday

Test	Sample Container	LTAT	Reference Interval	Remarks
			Females: (20-49 years): 0.29-1.67 nmol/L (\geq 50 years): 0.101-1.42 nmol/L	
Thyroid Stimulating Hormone (TSH)	Plain tube	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
Thyroid Stimulating Hormone (TSH), Neonates	Plain tube	Urgent: 1 day Routine: 3 days	<20 mIU/L	This test is use for Congenital Hypothyroidism Screening Programme (Cord Blood TSH)
Thyroid Stimulating Hormone (TSH), Pregnancy	Plain tube	Urgent: 1 day Routine: 3 days	1st trimester (6-12 weeks): 0.093-3.321 mIU/L 2nd trimester (13-27 weeks): 0.067-3.589 mIU/L 3rd trimester (28-40 weeks): 0.193-3.600 mIU/L Manufacturer (adult): 0.270-4.200 mIU/L	The trimester-specific reference interval was established on COBAS PRO Roche. Marked variation between analytical platform should be noted.
Total Protein, peritoneal fluid	Sterile container/ Bijou bottle	6 hours	Methodology of analysis for body fluid is not validated. Thus, reference range is not available.	

Test	Sample Container	LTAT	Reference Interval	Remarks
Total Protein, serum	Plain tube	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	
Total Protein, urine	Sterile container/ 24hr urine container	1 working day	Random: <0.150 g/L 24-hour: <0.140 g/day	
Transferrin	Plain tube	3 working days	2.0-3.6 g/L	
Triglycerides	Plain tube	6 hours	Normal: <1.7 mmol/L	Reference: Malaysian Clinical Practice Guidelines Management of Dyslipidaemia 2023
Urea, serum	Plain tube	Urgent: 4 hours Routine: 6 hours	2.76-8.07 mmol/L	
Urea, urine	Sterile container/ 24hr urine container	1 working day	24-hour: 428-714 mmol/day	
Uric Acid, serum	Plain tube	6 hours	Males: 202.3-416.5 µmol/L Females: 142.8-339.2 µmol/L	
Uric Acid, urine	Sterile container/ 24hr urine container	1 working day	Random: 2200-5475 µmol/L 24-hour: 1200-5900 µmol/day	
Urine Protein Creatinine Index (UPCI), random	Sterile container	3 workings day	Normal to mildly increased <0.015 g/mmol Moderately increased 0.015-0.05 g/mmol	Conversion factor: g/mmol x 1000 = mg/mmol

Test	Sample Container	LTAT	Reference Interval	Remarks
			Severely increased >0.05 g/mmol	
Valproic Acid	Plain tube	Urgent: 1 day Routine: 3 days	Therapeutic: 346.5-693 µmol/L Toxic: >693 µmol/L	Conversion factors: ug/mL x 6.93 = umol/L ug/mL x 1.0 = mg/L
Vancomycin	Plain tube	Urgent: 1 day Routine: 3 days	Peak: 13.8-27.6 µmol/L Trough: 3.45-6.9 µmol/L	Conversion factors: µg/mL x 0.69 = µmol/L µg/mL x 1.0 = mg/L
Vitamin B12	Plain tube	5 working days	145-569 pmol/L	Interval between order is 3 months. Please call Pathology MO/Specialist if indicated. Run every Wednesday & Friday
Vitreous Humour Biochemistry • Chloride • Glucose • Potassium • Sodium	Plain tube	6 hours	Methodology of analysis for body fluid is not validated. Thus, reference range is not available.	

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

**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
*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
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	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
	tube after centrifugation				
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
*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-Mullerian Hormone (AMH)	Plain tube	2 ml	Special Chemical Pathology Unit, HKL	10 working days	PER-PAT 301 Must be stamped

**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
					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

*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
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
*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
Cyclosporine	EDTA tube	2 ml	Core Lab, 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
Digoxin	Plain tube WITHOUT gel (red cap) For lab: Transfer	5 ml	Chemical Pathology Laboratory,	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
	serum to secondary tube after centrifugation		Hospital Selayang		
*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
Everolimus	EDTA tube	2 ml	Core Lab, 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	3 ml	Drug & Toxicology Unit, HKL	3 working days Sample analysis on Tues & Thurs	Antifungal TDM Request Form Must be stamped and signed ONLY by Infectious Disease (ID) Physician, Anaesthesiologist/

*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
					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
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

**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
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-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	3 ml	Drug & Toxicology Unit, HKL	3 working days	Antifungal 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
	serum to secondary tube after centrifugation			Sample analysis on Tues & Thurs	Must be stamped and signed ONLY by Infectious Disease (ID) Physician, Anaesthesiologist/ Intensivist, or Haematologist
Itraconazole, 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	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

**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
*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 day	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
Methotrexate (MXT)	Plain tube WITHOUT gel (red cap) For lab: Transfer serum to secondary tube after centrifugation	4 ml (1 ml acceptable for paedes)	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	EDTA tube/	2-5 ml (1-2 ml acceptable for infants)/	Molecular Diagnostic Unit, SDC IMR	5 months	IMR Request Form for Molecular

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Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
Ophthalmoplegia (CPEO)	Urine container/ Sterile container	Urine sediment (20 ml of early morning urine)/ Muscle biopsy			Diagnostics Services
*Mitochondrial DNA Deletion Syndromes - Kearns-Sayre 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 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

**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
*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
*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

**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
*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
Panel Diabetes Antibodies (Islet Cell Antibody (ICA), Glutamic Acid Decarboxylase Antibody (GAD) & Tyrosine Phosphatase-like proteins Antibody (Anti-IA2)	Plain tube	3 ml	Special Chemical Pathology Unit, HKL	10 working days	PER-PAT 301 Must be stamped and signed by Specialist
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
*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

**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
*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	3 ml	Drug & Toxicology Unit, HKL	3 working days 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	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:	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

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Test	Container/ Special Requirements	Volume	Performing Referral Lab	Referral Lab TAT	Form
	Aliquot 24-hour urine in urine container				
*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
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)	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

**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
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	Core Lab, 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 working 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
Voriconazole, 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	Antifungal TDM Request Form Must be stamped and signed ONLY by Infectious Disease (ID)

*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
					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 Adrenoleukodystrophy	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

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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	<ul style="list-style-type: none">• Clotted samples affect all haematology tests• It is recommended to follow guideline in collection tube section
Inappropriate sample – anticoagulant ratio	<ul style="list-style-type: none">• Incorrect blood volume (underfilling and overfilling) affects ESR and coagulation test result i.e. PT, APTT
Haemolysis	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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 D-Dimer 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 prolonged PT and APTT result. 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	TAT	Reference Interval	Remarks
Activated Partial Thrombin Time (APTT)	3.2% sodium citrate	Paeds: 1.8 ml Adult: 2.7 ml	Urgent: 90 minutes Routine: 4 hours	20.3 - 29.9 secs	Send immediately after collection
Bone Marrow Aspiration	Slide smear		Urgent: 3 days Routine: 7 working days	-	By appointment
Bone Marrow Trepine Biopsy	Sterile urine container with 10% formalin	Minimum 1.5 cm	30 days		By appointment
CD4/CD8 Enumeration	EDTA	2 ml	5 days	CD4+ cells: 24-48% 358-1279 cells/ μ L CD8+ cells: 15-38% 268-925 cells/ μ L CD3+ cells: 56-81% 831-2240 cells/ μ L	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	90 mins	<500 ng/ml	External: Freeze the plasma if sample cannot be analysed within 4 hours of collection

Test	Sample Container	Volume	TAT	Reference Interval	Remarks
Erythrocyte Sedimentation Rate (ESR)	ESR tube (sodium citrate 3.8%)	1.3 ml	3 hours	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	Reference: Dacie & Lewis 12th Edition
Fibrinogen	3.2% sodium citrate	Paeds: 1.8 ml Adult: 2.7 ml	90 mins	200.1 – 442.6 mg/dL	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	Urgent: 45 minutes Routine: 4 hours	Refer table: Full Blood Count Reference Interval	
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
G6PD Quantitative Assay	EDTA	Paeds: 0.5 ml Adult: 2 ml	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

Test	Sample Container	Volume	TAT	Reference Interval	Remarks
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	6 weeks	Refer table: Hb Analysis Reference Interval National Haematology Workshop Langkawi, 2015 Tosoh Bioscience	Please refer to: Thalassemia/ Haemoglobinopathy Screening 3 months post transfusion Please exclude IDA before sending Hb analysis performed in Hospital Selayang, 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	Urgent: 90 mins Routine: 4 hours	9.5 – 11.1 sec	Send immediately after collection
Reticulocyte count	EDTA	Paeds: 0.5 ml Adult: 2 ml	4 hours	0.5-2.5%	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.

BONE MARROW ASPIRATION AND TREPINE 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 Trepine 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
Immuno-phenotyping (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	<ul style="list-style-type: none"> • 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 12 th 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		
	6-17 Years	11.5-15.5		
RBC (10 ¹² /L)	Males	4.53-5.95	<ul style="list-style-type: none"> • 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 	Ambayya et al, 2014
	Females	3.87-5.21		Dacie & Lewis 12 th Edition
	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		
	6-17 Years	4.0-5.2		
Haematocrit (%)	Males	40.0-50.0		Dacie & Lewis 12 th 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		
	6-17 Years	35.0-45.0		

Test	Reference Interval		Interference	Reference
MCV (fL)	Adult	83.0-101.0	<ul style="list-style-type: none"> 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 12 th 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		
	6-17 Years	77.0-95.0		
MCH (pg)	Adult	27.0-32.0		Dacie & Lewis 12 th Edition
	0-2 Days	31.0-37.0		
	3-6 Days			
	7-13 Days			
	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		
	6-17 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		
	6-17 Years			
RDW-CV (%)	Adult	11.6-14.0	<ul style="list-style-type: none"> Very high WBC count, high concentration of very large or 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 12 th Edition

Test	Reference Interval		Interference	Reference
Platelets (10 ⁹ /L)	Adult	150-410	<ul style="list-style-type: none"> • 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 12 th 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		
	6-17 Years	170-450		
WBC (10 ⁹ /L)	Adult	4.0-10.0	<ul style="list-style-type: none"> • 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 12 th 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		
	6-17 Years	5.0-13.0		
Neutrophils (%)	Adult	40.0-80.0		Dacie & Lewis 12 th Edition
Neutrophils (10 ⁹ /L)	Adult	2.0-7.0	<ul style="list-style-type: none"> • 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		
	3-12 Months	1.0-6.0		
	1-2 Years	1.0-7.0		
	2-6 Years	1.5-8.0		
	6-17 Years	2.0-8.0		
Lymphocytes (%)	Adult	20.0-40.0		Dacie & Lewis 12 th Edition
Lymphocytes (10 ⁹ /L)	Adult	1.0-3.0		
	0-2 Days	3.0-8.0		

Test	Reference Interval		Interference	Reference
	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		
	6-17 Years	1.0-5.0		
Monocytes (%)	Adult	2.0-10.0		Dacie & Lewis 12 th 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			
6-17 Years				
Eosinophils (%)	Adult	1.0-6.0		Dacie & Lewis 12 th 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			
6-17 Years				
Basophils (%)	Adult	1.0-2.0		Dacie & Lewis 12 th Edition
Basophils (10 ⁹ /L)	Adult	0.02-0.1		
NRBC (10 ⁹ /L)	Adult	0.0-30.00		
NRBC %	Adult	0.00-0.50		

Test	Reference Interval		Interference	Reference
Reticulocyte (%)	Adult	0.5-2.5		Dacie & Lewis 12 th 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		
	3-12 Months	40-100		
	1-2 Years	30-100		
	2-6 Years	30-100		
	6-17 Years	30-100		
RET-He (pg)	Day 2 - 4 months	28.1 – 37.7		Reference interval for reticulocyte haemoglobin content in healthy infant, 2018
	4 months - 1 year	25.6–33.4		
	1-20 Years	24.9-34.1		Establishment of Age & Gender Specific Reference Ranges for 36 Routine & 57 Cell Population data items in a New Automated Blood Cell Analyser Sysmex XN-2000, 2015
	Adult male			
	20-40 Years	31.12-36.24		
	41-60 Years	31.61-36.38		
	>60 Years	31.3-37.39		
	Adult female			
	20-40 Years	25.69-34.77		
	41-60 Years	28.36-35.68		
>60 Years	29.81-36.50			
IPF (%)	Adult	1.0-7.3		Ko et al, 2014

GUIDE FOR G6PD SCREENING AND ASSAY IN PAEDIATRICS

G6PD Screening Result	Action
Deficient / Intermediate (Female)	To send G6PD Assay
Intermediate (Male)	To send G6PD Assay

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	Blood	Adult: 3 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
Protein C		Paeds: 2 tubes				
Protein S		<i>*For paediatric samples please use adult size tubes</i>				
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	2 tubes 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
	Bone Marrow	1 tube x 4 ml				

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	TAT	Special Requirement/ Forms
Chromosome Analysis (for genetic disease)	Blood	1 tube x 4 ml	Lithium heparin	Cytogenetics Unit, HTA, KL (ext. 2711)	10 weeks	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	Adult: 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 Request form: DNA analysis of Thalassemia Syndromes & Hemoglobinopathy's Request Form
DNA Analysis Beta Thalassemia	Blood	Adult: 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

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	TAT	Special Requirement/ Forms
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
Immunopheno-typing (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 before 9 am Do not send on PH and eve of PH Request form: PER-PAT 301
Lupus anticoagulant (LA)	Blood	Adult: 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 Patient Selection for LA Testing Request form: PER-PAT 301

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	TAT	Special Requirement/ Forms
Molecular Analysis for Leukaemia	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 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 (03-26162540/ 2590) for details			Unit of Molecular Diagnostics and Protein (UMDP), IMR KL	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

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	TAT	Special Requirement/ Forms
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 <u>Request form:</u> 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) <u>Request form:</u> 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) <u>Request form:</u> 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.

PATIENT SELECTION FOR LUPUS ANTICOAGULANT TESTING

Indicated for Lupus Anticoagulant

- i. Presence of both arterial and venous thrombosis
- ii. Unexplained arterial thrombosis (stroke or myocardial infarction) with no apparent risk factor and age <50 years old
- iii. ≥ 3 unexplained miscarriages of <10 weeks of gestation
- iv. ≥ 1 unexplained foetal death of ≥ 10 weeks of gestation
- v. Premature birth (<35 weeks) of normal morphology associated with severe pre-eclampsia, HELLP syndrome, intrauterine growth restriction (IUGR), stillbirth
- vi. Patient with unprovoked deep vein thrombosis (DVT) or pulmonary embolism (PE) who are planned to stop anticoagulant
- vii. Systemic Lupus Erythematosus (SLE)
- viii. Repeat LA (after >12 weeks from previous positive LA)

Could be considered for Lupus Anticoagulant

- i. Immune thrombocytopenia particularly with presence of arthralgia or arthritis, hair loss, sun sensitivity, mouth ulcer, rash, thromboembolism
- ii. Livedo reticulocytosis, particularly with presence of symptoms of other systemic autoimmune diseases or mild thrombocytopenia
- iii. Younger patient (<50 years old) with non-criteria clinical manifestations: those not included in the Sydney criteria. e.g., cognitive dysfunction, valvular heart disease with presence of the evidence of other systemic autoimmune diseases
- iv. Younger patients (<50 years old) following the provoked VTE when the provoking environment factor is disproportionately mild
- v. Patient with unexplained prolonged APTT as an incidental finding

Not indicated for Lupus Anticoagulant

- i. Acute events (<6 weeks)
- ii. On anticoagulant
 - Vitamin K antagonist - suggest to send 2 weeks after discontinuation
 - Unfractionated heparin - suggest to send 24 hours post dose
 - Low molecular weight heparin - suggest to send 12 - 24 hours after last dose
 - Direct thrombin inhibitors (e.g. dabigatran, argatroban and etc.) - suggest to send 72 hours post dose
 - Factor Xa inhibitors (e.g. rivaroxaban and etc.) - suggest to send 72 hours post dose
- iii. History of plasma products transfusion within 2 weeks of testing
- iv. Unsuitable for analysis: Pregnancy (exception in life threatening condition or decision of management). Advise for LA post-partum

LIST OF REQUEST FORMS

Forms	Code	Description
Borang Permohonan Ujian Perkhidmatan Patologi	PER-PAT 301	For other tests
DNA Analysis for Thalassemia Syndromes & Haemoglobinopathies 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 blood transfusion service plays a role by ensuring a reliable and adequate supply of safe and effective blood products.

It encompasses transfusion laboratory testing, clinical transfusion consultation, transfusion audit and monitoring of transfusion reaction.

The unit will ensure that the correct blood is given and that any adverse reactions are dealt with promptly and efficiently.

LIST OF TESTS

Test		TAT
Antibody Identification		14 working days
Coombs's test		2 hours
Group, Screen and Crossmatch (GXM)		2 hours
Urgent Full crossmatch (uGXM)		45 mins
Group, Screen and Hold (GSH)		2 hours
GSH convert to GXM		1 hour
Urgent GSH convert GXM (cGXM)		45 mins
Immediate spin phase/ 1 st Stage GXM		< 30 mins
Blood components	If blood group known: Platelets	10 mins
	If blood group unknown: Platelets	20 – 30 mins
	Fresh Frozen Plasma, cryoprecipitate and cryosupernatant	20 – 30 mins

BLOOD TRANSFUSION PROCEDURES

The decision to transfuse should be made based on clinical judgment. The benefit and risk must be assessed, and alternative therapy should consider.

Blood transfusion carries various risks to the health of the patient including transmission of infectious disease agents (HIV, Hepatitis, and Syphilis), transfusion reaction and even risk of transfusing wrong blood, which may be fatal.

Process and procedure should be in place to ensure patient safety. Blood transfusion should be avoided after office hours except in emergency.

1. Consent for Transfusion

The decision to transfuse and consent should be made at advance with patient, parent or guardian before any planned transfusion. Patient planned for transfusion must be informed on indication, benefits, potential risk and alternatives to the transfusion therapy.

The patient should be given opportunity to ask questions. The discussion between clinician and patient should be documented in patient's health records and does not require the signature of the patient. The consent form needs to be signed by the patient before the transfusion.

If the patient is unable to give written consent, a responsible family member must be asked to do so. In an emergency and if no family member available, when the need for transfusion leaves no time for written consent, the decision shall be made by two fully registered medical practitioners, note in patient's health record and this information should be provided to patient or family member of the patient after transfusion.

2. Blood Ordering and Sampling

The process of taking and **labelling blood samples must be done in one process at the bedside, one patient only at any one time**. The requesting doctor shall be responsible to ensure:

- i. Use own personnel log in HIS
- ii. Place order on correct patient's chart
- iii. Print the specimen label, collect sample and label it
- iv. Fill in the blood requesting form

3. Patient Identification

Accurate identification of patients at all stages of the blood transfusion process is essential. Confirm patient's name and identification by:

- i. Asking the patient to state his/her full name (*open-ended question*)
- ii. Read the details on patient's wristband
- iii. Check the patient's information on clinical notes and printed specimen label

The unconscious patients **MUST** be identified by the information given on the wristband. If the patient is unconscious and unknown, it is acceptable to use "Unknown" with the medical record number, which is assigned to the patient on arrival. This number must be used to identify this patient until full and correct personal details are available.

4. Labelling of Sample

- i. Label all samples immediately in the patient's presence at the bedside. The person who draws the blood should label the samples
- ii. Label the tubes after drawing blood, **not before**
- iii. Confirm that all tubes are labelled correctly with the patient's wristband
- iv. Never label samples for two or more patients at the same time

5. Blood Requesting Form

Prescribing blood and blood products are the responsibility of the doctor managing the patient. The request form and request through the eHIS system should be complete.

The relevant patient information should include:

- i. Patient's details: Name, IC number, hospital registration number
- ii. Current working diagnosis
- iii. Indication for transfusion
- iv. Previous transfusion history
- v. Patient's consultant name
- vi. Blood group if known
- vii. Latest haemoglobin level
- viii. The test required
- ix. The quantity of blood bags requested

The request form should be signed by the requesting doctor and his/her name should be stamped or written clearly in block letters.

6. Receiving Request

The blood sample shall be sent to the blood bank either:

- i. Walk in at counter blood bank
- ii. Via pneumatic tube system (115)

Tests or samples that cannot be sent via pneumatic tube are:

- Transfusion Reaction Workout

Blood bank personnel must ensure that the request form is properly filled, and the corresponding samples are correctly labelled before accepting the request.

7. Rejection of Requests

- i. Rejection shall comply with local policies and procedures
- ii. However, in **life threatening situations**, blood bank shall immediately facilitate the resolution of any discrepancies that cause the rejection of the request by discussing the case with the requesting clinician
- iii. Any resolution including that made through a telephone conversation shall be fully documented

8. Pre-Transfusion Testing

Tests	Remarks
Group, Screen and Hold (GSH)	<ul style="list-style-type: none"> Performed for cases where probability of transfusion is low Comprises of ABO blood grouping, Rh(D) typing and antibody screening. Patient's sample will be retained in blood bank for 48 hours. If transfusion required, the sample will be converted to crossmatched. After 48 hours, a fresh new sample is required for crossmatch.
Group and Crossmatching (GXM)	<ul style="list-style-type: none"> Performed for cases where probability of transfusion is high. Comprises of ABO grouping, Rh(D) typing, antibody screening and crossmatching. Crossmatched blood units will be kept in reserved for 48 hours before blood bag collection.
Antibody screening	<ul style="list-style-type: none"> Perform in GSH and GXM request Consists of Cell I, II & III screening If positive, need to proceed with antibody identification
Direct coomb's test (DCT)	<ul style="list-style-type: none"> Performed in positive antibody screening investigation Investigation for transfusion reaction For new born babies Investigation for incompatible crossmatching <ul style="list-style-type: none"> Performed on donor blood bag A part of Coomb's test Done on Safe O blood bag
Auto control	<ul style="list-style-type: none"> Performed in positive antibody screening investigation Detect the presence of autoantibodies
Antibody Identification	<ul style="list-style-type: none"> Antibody identification shall be carried out whenever the antibody screening test is positive In life- threatening situations, crossmatch compatible blood will be supplied only after receiving pre-transfusion sample for Antibody Identification (after discussion with MO Blood Bank or TMS) In non-urgent situations, sample will be sent to IH Lab HSgB (for DCT Negative) and to IH Lab PDN (for DCT Positive & Inconclusive result).

9. Blood Samples

A blood sample is required prior to a transfusion to ensure compatibility of blood groups between donor and recipient and to screen patients for atypical red cell antibodies which can potentially cause reactions.

Requirement for blood samples for pre-transfusion testing:

a. Blood sample for red cells (GSH /GXM)

More than 6 months old & adult

- i. 3 ml – 5 ml blood in EDTA tube
- ii. If no previous ABO blood grouping record in the system, second sample needed

- iii. Completed Blood Transfusion Request form
- iv. Need MO code

Less than 6 months old

- i. 3 ml – 5 ml **mother's** blood in EDTA tube
- ii. 1 – 1.5 ml **infant** blood in EDTA tube
- iii. The Infant's blood sample should **ALWAYS** be accompanied by mother's blood sample
- iv. If the maternal blood is unavailable, 3 ml infant's blood is required for testing
- v. To fill in request **two** Blood Transfusion Request form for each sample (infant and mother)
- vi. Generate barcode under paedy packed cell request. Mother's details needed
- vii. Second sample for ABO grouping required if no previous record available in system (for baby and mother).
- viii. Need MO code

b. Blood sample for Coomb's Test

- i. 3 ml – 5 ml blood in EDTA tube for adults, 1 ml for infants below 6 months old
- ii. Completed Blood Transfusion Request form
- iii. No MO code needed

c. Blood sample for Component Request

- i. 3 ml – 5 ml blood in EDTA tube
- ii. If no previous ABO blood grouping record in the system, second sample is needed
- iii. If patient had received a transfusion of blood within the previous 3 months and the procedure was without any complications, a new blood sample need **NOT** accompany requests for more blood components. Only barcode for components required
- iv. Component request **MUST** be order separately with separate barcode & Blood Transfusion Request form
- v. Need MO code

d. Blood sample for Antibody Identification

- i. 10 ml of blood / 3 EDTA tubes
- ii. 10 ml blood / 3 plain tubes
- iii. Completed Blood Transfusion Request form
- iv. No need MO code

e. Blood sample for Elective Transfusion and Surgery (GSH/GXM)

- i. 3 ml – 5 ml EDTA tube. Second sample needed if no previous blood group record
- ii. Should be sent during office hours only
- iii. Sample **MUST** send one day prior to operation date (24 hours)
- iv. Request is based on MSBOS or case by case
- v. GXM conversion will be done during office hour
- vi. Blood bank MO code is required after 5 pm

vii. Completed Blood Transfusion Request form

f. Blood sample for Emergency Transfusion (GXM)

All emergency requests shall be followed by a phone call to alert the blood bank staff to facilitate the process. The clinician/ house officer in charge shall send sample directly to blood bank and wait until the blood is ready for collection.

- i. 3 ml – 5 ml in EDTA tube
- ii. Completed Blood Transfusion Request form
- iii. Second blood sample for ABO grouping confirmation (**MANDATORY** for patient who has no previous record of ABO blood group in the system)
 - Should be collected at **different time** from the 1st blood sample collection

g. Massive Transfusion Protocol (MTP)

- i. MTP activation decision should be made by attending specialist
- ii. Clinical coordinator appointed by the attending specialist to activate the MTP
- iii. Coordinator shall appoint one runner, responsible in transporting samples & blood products
- iv. Inform blood bank and provide full required information
- v. Inform blood bank medical officer
- vi. Ensure sufficient blood sample in EDTA tube, completed Blood Transfusion Request form before sending to blood bank
- vii. Ensure the sample reaches the blood bank on time to avoid delay
- viii. Ensure that the runner well prepared with collection box
- ix. Deactivate MTP. Deactivation once bleeding secured and hemodynamically 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	CODE 2
4 units PC	4 units PC
4 units FFP	4 units FFP
4 units Plt	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:

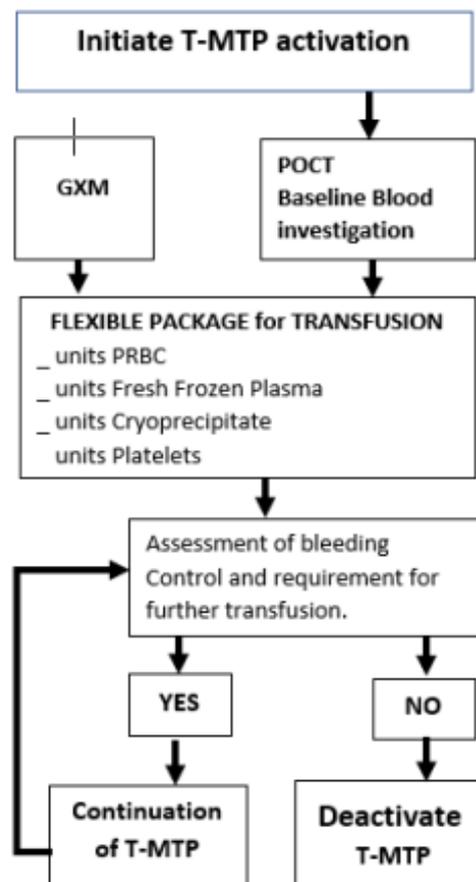
1. Transfusion of half of one blood volume in 3 hours, or more than one blood volume in 24 hours (adult blood volume is approximately 70mL/kg)
2. Transfusion of more than 40ml of blood/kg in a child (blood volume of children older than neonates is approximately 80 ml/kg).

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

h. Targeted Massive Transfusion Protocol (T-MTP)

The Targeted Massive Transfusion Protocol (T-MTP) is a strategy designed **for rapid and individualized blood transfusion** for patients experiencing significant bleeding. T-MTP allows clinicians to determine the specific type, amount, and ratio of blood products needed for effective resuscitation. This strategy is guided by objective clinical assessments and Point of Care Testing (POCT) methods, such as Full Blood Count, Blood Gas Analysis, and viscoelastic assays.

- i. T- MTP activation decision should be made by attending specialist
- ii. Clinical co-coordinator appointed by the attending specialist to activate the T-MTP
- iii. Coordinator shall appoint one runner, responsible in transporting samples & blood products
- iv. Inform blood bank and provide full required information
- v. Inform blood bank medical officer
- vi. Ensure sufficient blood sample in EDTA tube, completed Blood Transfusion Request form before sending to blood bank
- vii. Ensure the sample reaches the blood bank on time to avoid delay
- viii. Ensure that the runner well prepared with collection box
- ix. Deactivate MTP. Deactivation once bleeding secured and hemodynamically stable



10. Selection of Red Cells for Transfusion

- i. For routine transfusion, packed red cells should be used in preference to whole blood.
- ii. Red blood cell products should be of the same ABO and Rh(D) type as the patient whenever possible.
- iii. The choice of red cells for infant less than 6 months of age is Group O Rh(D) positive pack red cells (paedy-bag).

11. Transfusion in Special Circumstances

Emergency uncrossmatched blood group O (safe O)

- i. In life threatening situation, clinician shall choose to transfuse group O Rh(D). Positive buffy coat poor packed cell or pack cell for resuscitation which made available in Emergency Department (ED) and Operation Theatre (OT).
- ii. Decisions to transfuse uncrossmatched safe group O blood must only be made after the responsible clinician has fully assessed the patient's condition. The decision should not be made in haste.
- iii. The requesting doctor must state the reasons for such a decision on the request form/ clinical note/patient's chart in eHIS and sign it.
- iv. Pre-transfusion blood sample must be collected before the transfusion.
- v. Pre-transfusion sample and the completed empty safe O bag should be sent to blood bank **IMMEDIATELY** for ABO & Rh(D) blood grouping and crossmatching.
- vi. Any incompatibility detected shall be informed immediately to the requesting clinician.
- vii. Replacement of used safe O bag will be done once unit consumption is completed by the respective department/clinician in the system.

Saline phase crossmatched blood (1st stage)

- i. Red cell transfusion needed urgently but not as immediate where the patient's lives are in immediate danger.
- ii. Transfusion of ABO-matched red cell is preferable compared to uncross matched group O Rh(D) positive packed cell.
- iii. Emergency crossmatch is done by saline phase at room temperature and shall be available in 20 minutes.
- iv. Full cross-match shall continue after the blood is issued and any incompatibility detected shall be informed immediately to the requesting clinician.

12. Issuance, Collection & Returned Unused Blood and Blood Component

- i. Blood bank staff shall ensure that correct blood and blood component is being issued.
- ii. The date and time of issue and collection shall be recorded by the blood bank personnel.
- iii. The record shall include the details of the person issuing and the person collecting the blood or blood product.
- iv. The person collecting the blood shall provide a documentary proof of the patient identity (blood collection slip or barcode label).
- v. The person collecting the blood shall ensure that correct blood and blood component has

- been supplied to him/her before leaving the blood bank counter.
- vi. Issued blood bag shall be **transfused without undue delay**.
- vii. The prepared blood and blood component shall be kept in blood refrigerators in blood bank at appropriate temperature.
- viii. Collect blood bag only if required for immediate transfusion.
- ix. Transportation shall be carried out in an appropriate temperature to maintain cold chain system.
- x. The ward shall maintain the blood at appropriate temperatures and condition until they are used or returned to the blood bank immediately
- xi. The ward shall **return untransfused blood immediately to blood bank**.
- xii. The ward shall inform the blood bank if any of the untransfused blood returned has not complied with the storage or transportation temperature.
- xiii. Untransfused blood that returned shall be discarded unless it is kept in an appropriate condition and temperature.
- xiv. The returned of unused blood shall be kept until the next stock check following day (8 am and 2 pm).

13. Administration of Blood Product

- i. Confirm the patient's name and identification by asking the patient or relative to and by checking:
 - a. The patient's note
 - b. Compatibility card
 - c. Request form
 - d. Wristband
 - e. Check the expiry date of blood or blood component
- ii. Record the blood transfusion detail in patient's note
 - a. Type of product transfused
 - b. Product barcode number
 - c. Date of transfusion
 - d. Volume transfused
 - e. Time transfusion started and ended
 - f. Adverse transfusion reaction, if any
- iii. The patient shall be closely observed and monitored during the transfusion. Parameters to be monitored shall include:
 - a. Blood pressure and pulse rate
 - b. Temperature
 - c. Clinical features of acute transfusion reactions
- iv. The vital signs shall be monitored and recorded:
 - a. Before starting transfusion
 - b. During the transfusion (close observation and monitoring for the first 5 to 10 minutes, and subsequently half hourly and then hourly. Perform vital sign monitoring every 15 minutes for unconscious patients receiving transfusion)
 - c. After completion of transfusion

14. Return of Used Blood Bags

- i. The ward shall be responsible to return used blood bags and completed compatibility card (PPDK) within 24 hours.
- ii. Unit consumption shall be completed in ward prior to return of the used empty bag.
- iii. The ward shall correctly and completely fill up a compatibility card. The compatibility card shall contain at least the following information:
 - a. Name of hospital
 - b. Ward
 - c. Full name of recipient
 - d. Identity card/passport number of recipient/hospital registration number of recipients
 - e. Recipient's blood group (ABO and Rh(D)), age and gender
 - f. Date of transfusion
 - g. Time transfusion starts and ends
 - h. Volume transfused
 - i. Adverse transfusion reaction, if any
 - j. Name and signature of staff starting transfusion
 - k. Name and signature of staff filling up card or form
- iv. The empty used bag and the completed compatibility card will be kept in blood bank for 7 days.

15. Return of Untransfused Blood

- i. The ward shall return all untransfused blood immediately to the hospital blood bank.
- ii. Untransfused blood and blood components that are returned to the blood bank must be kept in an appropriate condition and temperature.
- iii. The ward shall inform the hospital blood bank if any of the unused blood returned to the blood bank has not complied with the storage or transportation temperature.

16. Storage, Transportation and Duration for Transfusion of Blood

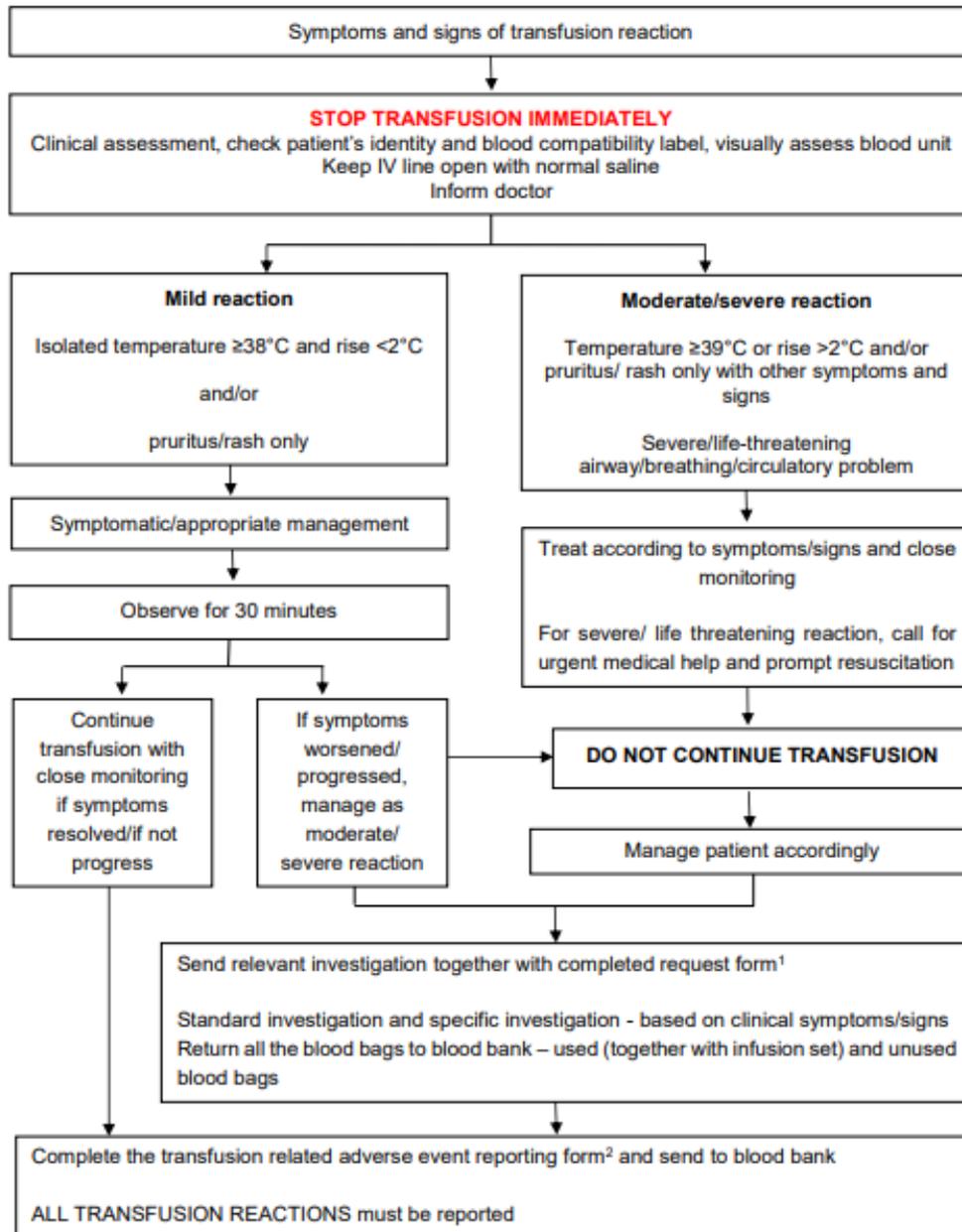
Blood Components	Red cells (all types of red cells)	Platelets	Thawed Plasma	Thawed Cryoprecipitate/ Cryosupernatant
Storage	2 - 6°C	20 - 24°C	Shall be issued once the product is thawed	Shall be issued once the product is thawed
Transportation	2 - 10°C	Should be kept at 20 - 24°C. NEVER put platelets 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. Transfusion Reaction

- i. All Transfusion Reactions shall be investigated, reported and managed accordingly.
- ii. If any adverse transfusion reaction suspected or detected, infusion should be stopped immediately.
- iii. Inform doctor **STAT**.
- iv. To facilitate investigation of an adverse transfusion reaction, the following shall be carried out:
 - a. **Post Transfusion Reaction Profile I:** For cases < 24 hours
 - b. **Post Transfusion Reaction Profile II:** For cases > 24 hours
 - c. 3ml of venous blood sample collected in EDTA tube
 - Repeat ABO/Regrouping
 - Repeat crossmatching
 - Direct and indirect antihuman globulin test (Combs' test) & antibody screening
- v. Additional blood for FBP, retic count, LDH, biochemistry (bilirubin, renal profile) and screening for those suspected haemolytic transfusion reactions.
- vi. 20 cc of urine sample for haemoglobinuria (if required)
- vii. 2 empty blood culture bottles (Aerobe & Anaerobe)
- viii. The remaining blood bag (partially transfused blood or unused blood bag) and tubing set without needle (closing it securely).
- ix. Completed transfusion reaction form (**BTS/TR/2/2016**)

Figure 16.1: Flowchart for management of acute transfusion reaction



Handbook on Clinical Use of Blood 3rd Edition, 2020

18. Transfusion Record

- i. All records of transfusions request shall be kept in blood bank and in the eHIS system, including those cases of screen and hold.
- ii. Document the details of the transfusion including blood unit transfused in the system/ PPKD card.
- iii. Return all used blood bag to blood bank - empty or not, and any unused units together with completed PPKD card.

19. Rare Blood Group

Rh(D) negative blood group:

- i. Minimal stock available in blood bank (only for emergency use)
- ii. In elective cases, blood bank shall be informed **at least two weeks** prior to the procedure that may require transfusion.
- iii. This notification is essential to allow the blood bank enough time to source for the required blood.
- iv. In emergency situation, where ABO group specific Rh(D) negative blood is not available in time, blood bank may issue, in order of preference:
 - a. Group O Rh(D) negative blood, or
 - b. ABO group specific Rh(D) positive blood, only if the patient does not have pre-formed anti D.
- v. This shall be done only after discussing with and agreed by the treating clinician.

LIST OF TESTS (REFERRED)

The LTAT stated is based on working days. For referred tests, TAT provided 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. As for reporting, lab usually takes 1 working day upon receiving the report.

Test	Sample Volume	Sample Container	Perform Site/ Referral Lab	Referral lab TAT	Special Requirement/ Forms
ABO Rh Confirmation	<p>Adult: EDTA: 10 ml (3 tubes) and Plain non-gel tube (red cap): 10 ml (3 tubes)</p> <p>*Paediatric: (<6 months old): EDTA: 1-2 ml and Plain non-gel tube (red cap): 1-2 ml</p> <p>*Send together with mother's samples</p> <p>Saliva for secretor study (for Bombay/ Parabombay cases only): 5-10 ml</p>	<p>EDTA</p> <p>Plain non-gel tube (red cap)</p> <p>Universal container (for saliva)</p>	IH, PDN	<p>Serology: 10 working days</p> <p>With molecular: 20 working days</p> <p>LTAT may vary depending on complexity of case</p>	<p>Borang Pemohonan Transfusi Darah</p> <p>Permohonan Rujukan Ujian Immunohematologi</p>
Antibody Identification	<p>Adult: EDTA: 10 ml (3 tubes) and Plain non-gel tube (red cap): 10 ml (3 tubes)</p> <p>*Paediatric: (<6 months old): EDTA: 1-2 ml and Plain non-gel tube (red cap): 1-2 ml</p> <p>*Send together with mother's samples</p>	<p>EDTA</p> <p>Plain non-gel tube (red cap)</p>	IH, PDN	<p>Serology: 10 working days</p> <p>With molecular: 20 working days</p> <p>LTAT may vary depending on complexity of case</p>	<p>Borang Pemohonan Transfusi Darah</p> <p>Permohonan Rujukan Ujian Immunohematologi</p>

Test	Sample Volume	Sample Container	Perform Site/ Referral Lab	Referral lab TAT	Special Requirement/ Forms
Cold agglutinin titre	<p>Adult: EDTA: 10 ml (3 tubes) and Plain non-gel tube (red cap): 10 ml (3 tubes)</p> <p>*Paediatric: (<6 months old): EDTA: 1-2 ml and Plain non-gel tube (red cap): 1-2 ml *Send together with mother's samples</p>	EDTA Plain non-gel tube (red cap)	IH, PDN	<p>Serology: 10 working days</p> <p>With molecular: 20 working days</p> <p>LTAT may vary depending on complexity of case</p>	<p>Borang Pemohonan Transfusi Darah</p> <p>Permohonan Rujukan Ujian Immuohematologi</p>
Isohemagglutinin (Titre Anti-A & Anti-B)	<p>Adult: EDTA: 10 ml (3 tubes) and Plain non-gel tube (red cap): 10 ml (3 tubes)</p> <p>*Paediatric: (<6 months old): EDTA: 1-2 ml and Plain non-gel tube (red cap): 1-2 ml *Send together with mother's samples</p>	EDTA Plain non-gel tube (red cap)	IH, PDN	<p>Serology: 10 working days</p> <p>With molecular: 20 working days</p> <p>LTAT may vary depending on complexity of case</p>	<p>Borang Pemohonan Transfusi Darah</p> <p>Permohonan Rujukan Ujian Immuohematologi</p>
Platelet Immunology Test	<p>Adult: EDTA: 10 ml (3 tubes) and Plain non-gel tube (red cap): 10 ml (3 tubes)</p> <p>*Paediatric: (<6 months old): EDTA: 1-2 ml and Plain non-gel tube (red cap): 1-2 ml *Send together with mother's samples</p>	EDTA Plain non-gel tube (red cap)	IH, PDN	<p>Serology: 10 working days</p> <p>With molecular: 20 working days</p> <p>LTAT may vary depending on complexity of case</p>	<p>In NAIT cases, samples must be obtained from biologically related parents only. Sample must be fresh</p> <p>Borang Pemohonan Transfusi Darah</p> <p>Permohonan Rujukan Ujian Platelet Immunologi</p>

Test	Sample Volume	Sample Container	Perform Site/ Referral Lab	Referral lab TAT	Special Requirement/ Forms
RBC phenotyping	3 ml Certain case if required by PDN: <ul style="list-style-type: none"> • EDTA: 10 ml (3 tubes) • Plain non-gel tube (red cap): 10 ml (3 tubes) 	EDTA	IH, PDN	Serology: 10 working days With molecular: 20 working days LTAT may vary depending on complexity of case	Borang Pemohonan Transfusi Darah Permohonan Rujukan Ujian Immunoematologi

LIST OF REQUEST FORMS

Forms	Code	Description
Borang Laporan Reaksi kepada Darah atau Komponen Darah	BTS/TR/2/2016	Transfusion Reaction Reporting (For clinician to fill up)
Borang Pemohonan Transfusi Darah	PER-SS-BT 105 (Pind. 1/2016)	For all tests in Transfusion Medicine
Borang Persetujuan Peminjaman Darah atau Komponen Darah	BTS/TC/2/2016	Consent form for patient
General PER-PAT Form	PER-PAT 301	RBC Phenotyping & other tests
Permohonan Rujukan Ujian Immunoematologi	PDN/IH/QP-05/01, ver 02	For Antibody Identification (Transfusion Medicine staff only)
Permohonan Rujukan Ujian Platelet Immunologi	PDN/IH/QP-05/02, ver 02	For Platelet Immunology Test (Transfusion Medicine staff only)
Reporting Form for Transfusion Related Adverse Event	BTS/HV/3/2016	For Transfusion Medicine staff
Worksheet for Investigation of Transfusion Reaction	BTS/TRW/2/2016	For Transfusion Medicine staff

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	<p>Blood</p> <ol style="list-style-type: none"> 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 <p>Tissue</p> <ol style="list-style-type: none"> 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	<p>An automated blood culture system with different types of bottles according to age and indication:</p> <ol style="list-style-type: none"> 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 <p>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.</p>
Bone marrow aspirate	<p>3 – 5 ml of aspirate is required and to be inoculated directly into the Mycobacteria/ Yeast/ Fungi blood culture bottles. (validated)</p> <ol style="list-style-type: none"> i. Before venepuncture, the skin must be carefully disinfected with alcoholic antiseptic

Bacteriology	
	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> i. Collect 3 – 4 ml of CSF into sterile Bijoux bottles for the examination of: <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> 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	<p>High vaginal swabs</p> <ul style="list-style-type: none"> 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 <p>Endocervical swab</p> <ul style="list-style-type: none"> 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 <p>Urethral discharge (Male)</p> <ul style="list-style-type: none"> 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 <p>Send specimens immediately to the laboratory. If transport is delayed, refrigerate sample at 2-8°C</p>
Mycobacterium: Acid-fast bacilli stains	<p>Acceptable specimens: Respiratory samples, CSF, body fluids, tissue biopsies</p> <p>For sputum</p> <ul style="list-style-type: none"> i. Collect in a sterile container ii. Collect a minimum of 2 specimens including 1 early morning sputum specimen where possible <p>Send specimens immediately to the laboratory. If transport is delayed, refrigerate sample at 2-8°C</p>
Mycobacterium: Acid-fast bacilli culture	<ul style="list-style-type: none"> 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

Bacteriology

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.

THIOGLYCOLATE BROTH



Introduction

Thioglycolate broth is an enrichment medium suitable for cultivation of anaerobic organisms.

Indication

For cultivation of anaerobic organisms from Pus Aspirate and Deep Tissue Infection.

Appearance

Straw-yellow coloured solution, with or without top, pink layer (A).

Storage

The medium should be stored in room temperature, away from light

Instructions to use

Directly inoculate samples (eg: tissue, pus aspirate, deep seated wound tissue) into thioglycolate broth.

Do not shake

Thioglycolate broth upon inserting the specimen.

Send to the lab immediately for incubation.

Caution

Do not use if the medium becomes oxidized (whole broth turns into pink color) (B).

Oxidised medium should be discarded

How to Collect?

Collect Thioglycolate broth from Pathology counter, one day prior to scheduled procedure (elective operation, USG/CT guide). For emergency procedures, please call extension 2128 before collection.

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

Bacteriology

	<p>culture <i>Corynebacterium diphtheriae</i> in a presence of suspicious pseudomembrane</p> <ol style="list-style-type: none"> 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 <p>Swab from mouth, gums and oral cavity</p> <ol style="list-style-type: none"> 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 <p>Sputum</p> <ol style="list-style-type: none"> 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 <p>Bronchial alveolar lavage (BAL) / brushings / biopsies</p> <ol style="list-style-type: none"> i. Place the specimen which is obtained via bronchoscopy into a sterile container v. Send the specimen to the laboratory immediately. If transport is delayed, refrigerate sample at 2-8°C
<p>Stool</p>	<ol style="list-style-type: none"> 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 <i>Vibrios</i> and Selenite F for <i>Salmonella</i> 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 <p>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 <i>completion</i> of therapy</p>
<p>Urine</p>	<p>A. <u>Midstream urine</u></p> <p>Male patients:</p> <ol style="list-style-type: none"> i. Withdraw the prepuce and cleanse the glans penis with soapy water and thoroughly rinse with water

Bacteriology

- 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. Catheterized urine

- 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. Bladder urine

- 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

Mycology	
Mouth	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 <p>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</p>
Serum	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> i. Collect 2 ml of CSF into a sterile container ii. Ensure the temperature is maintained between 2 - 8°C throughout transportation <p>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</p>
Urine	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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

Viral Genome Detection using Polymerase Chain Reaction (PCR) method

Tissue Biopsy	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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
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HIV Drug Resistance Test	
Plasma	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> i. Aseptically collect 1 – 3 ml into a sterile container ii. Send it to the lab as soon as possible
Vesicular lesion	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> i. Collect the scraping ii. Send it to the lab as soon as possible
Eye swab	<ul style="list-style-type: none"> i. Firmly rub the lesion with a sterile swab, which has been moistened with sterile distilled water ii. Put the swab into (VTM) <p>Note: DO NOT moisten swab with normal saline</p>
Throat swab	<ul style="list-style-type: none"> 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. <p>Note: Use Dacron swab. DO NOT use calcium alginate or cotton swabs or ones with wooden sticks</p> <ul style="list-style-type: none"> iii. Avoid swabbing the soft palate and do not touch the tongue with the swab tip. This procedure can induce the gag reflex. iv. Place the swab immediately into VTM v. Send it to the lab as soon as possible
Nasopharyngeal swab (NPS)	<ul style="list-style-type: none"> 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

Viral Isolation	
	<p>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</p> <p>Note: DO NOT use rigid shafted swabs for this sampling method – a flexible shafted swab is essential</p> <p>iv. Leave the swab in place for a few seconds. Withdraw slowly with a rotating motion.</p> <p>v. Put the tip of swab into VTM</p> <p>vi. Send it to the lab as soon as possible</p>
Nasopharyngeal aspirate (NPA)	<p>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</p> <p>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</p> <p>iii. Aspirate nasopharyngeal secretions and collect specimens in sterile container.</p>

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

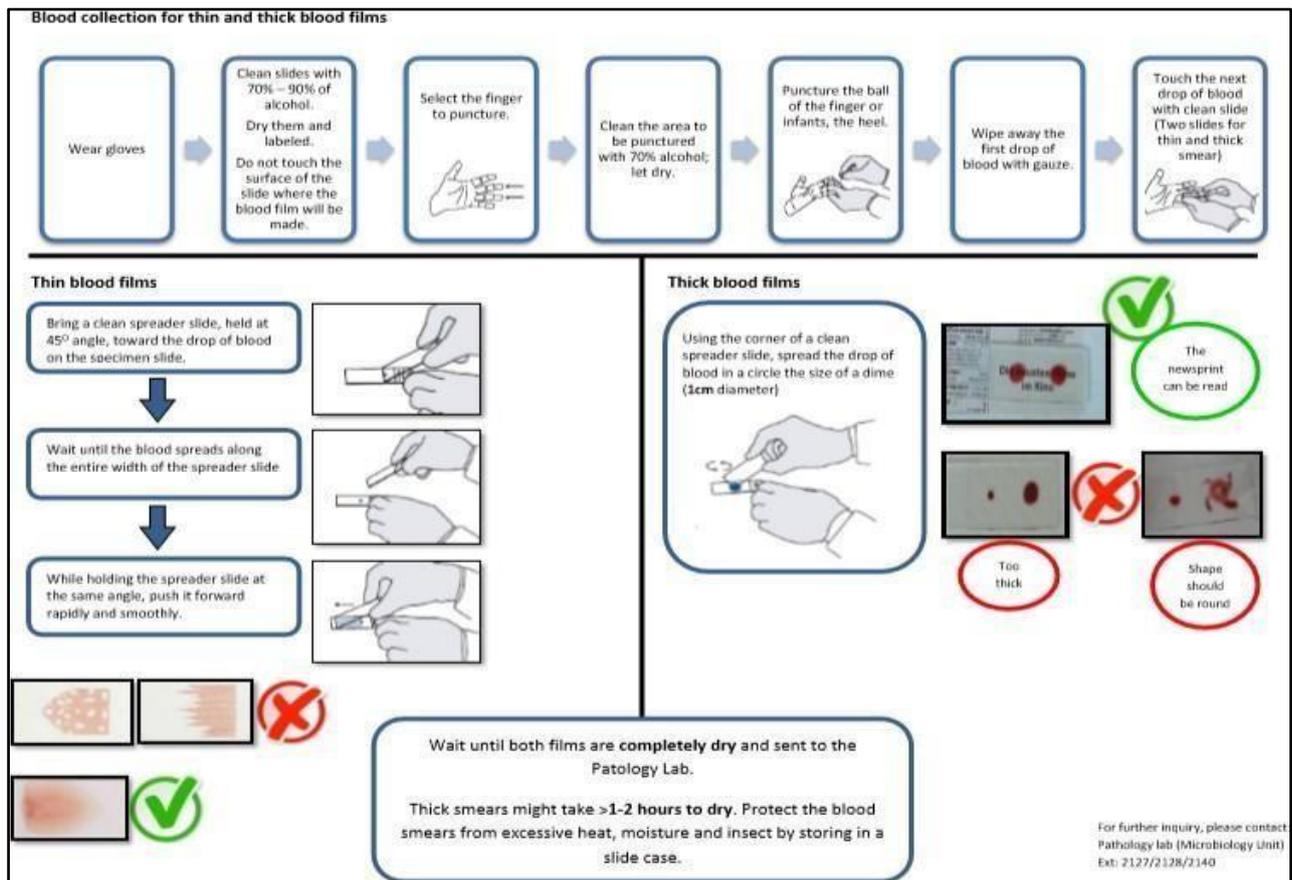
Test	Specimen	Volume	Container	TAT
Culture & Sensitivity (C&S) Body Fluid	Aqueous fluid Pericardial fluid Peritoneal fluid Pleural fluid Synovial fluid Vitreous fluid	1 - 3 ml	Sterile container	14 days
Culture & Sensitivity (C&S) Cerebrospinal Fluid	CSF	3 ml	Bijou bottle/ Sterile container	14 days
Culture & 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 Sputum Skin Tissue	Not applicable	Sterile container	28 days
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	3 ml	Sterile container	8 days

Test	Specimen	Volume	Container	TAT
	Corneal storage medium			
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

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

BFMP (Blood Film Malaria Parasite)

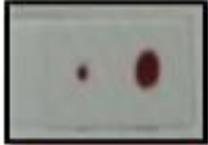


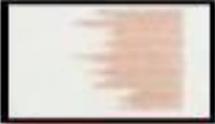
Good quality of BFMP slide

- 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

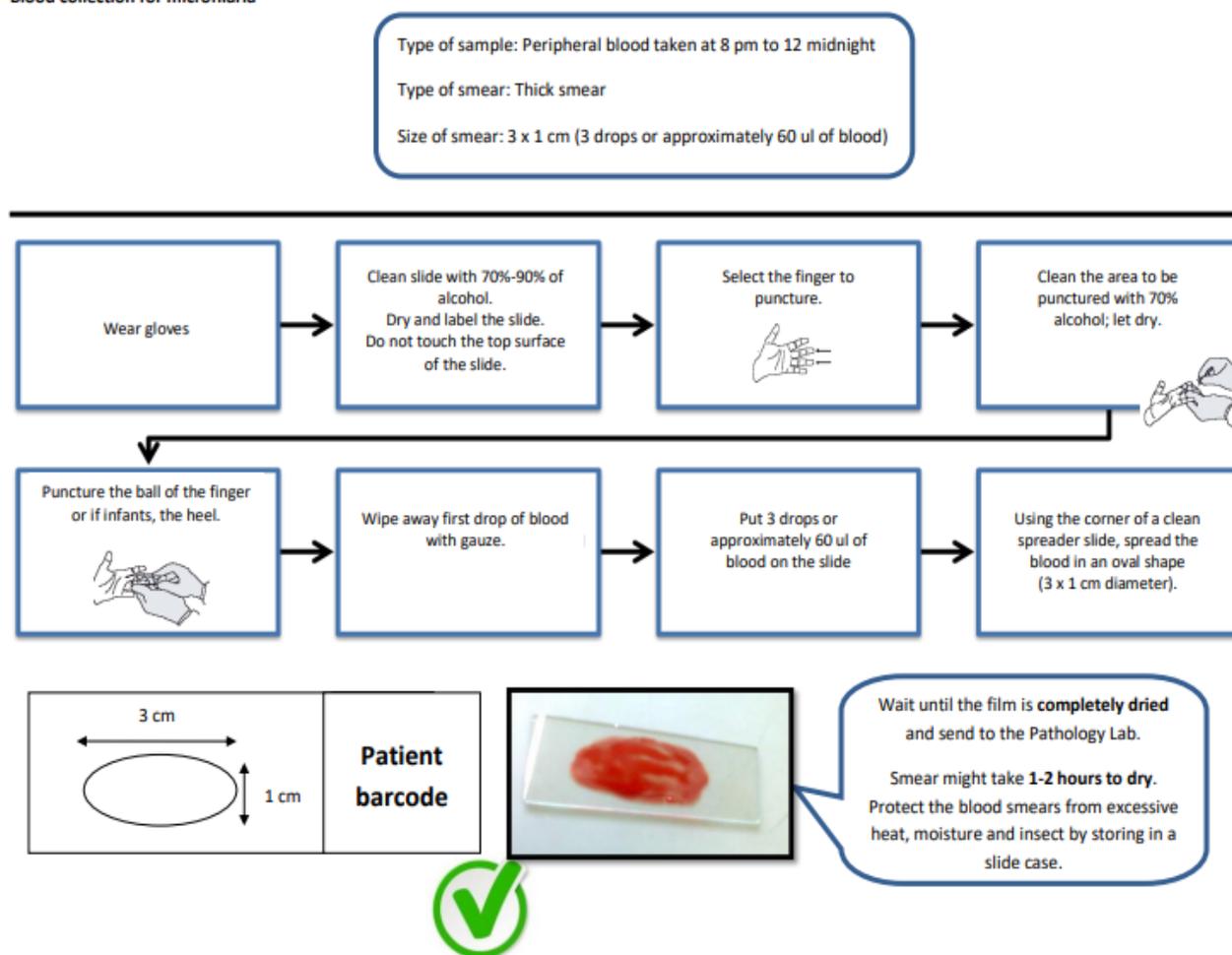


THICK FILM			The newspaper can be read
			
	Too thick	Shape should be round	

THIN FILM			
			
	Holes	Unevenly spread film	

Blood Film Microfilaria

Blood collection for microfilaria



Molecular

Test	Specimen	Volume	Container	TAT
BK Virus (BKV) Genome Detection	Plasma CSF Urine	5 ml 0.5 – 2 ml 5 ml	EDTA tube Sterile container Urine PCR Media	5 days
Cytomegalovirus (CMV) Genome Detection	Plasma CSF Urine	5 ml 0.5 – 2 ml 5 ml	EDTA tube Sterile container	5 days
Epstein-Barr Virus (EBV) Genome Detection	BAL CSF Plasma	5 ml 0.5 – 2 ml 5 ml	EDTA tube Sterile container	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	EDTA tube Sterile container VTM	5 days

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

Test	Specimen	Volume	Container	TAT
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 flocced 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 flocced 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

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

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
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 Bartonella Request Form
Bordetella Pertussis PCR	NPA/ Swab Transport in ice or in room temperature	1 - 2 ml	For Nasophary- ngeal aspirates, use sterile container For Nasophary- ngeal swab, use Dacron swab in Stuart's transport media Bacterial culture, tracheal aspirate, nasal swab Do not use calcium alginate or cotton swab	Bacteriology, NIH	3 days	Bacteriology Request Form
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 (Melioidosis)	Serum	2 - 3 ml	Plain tube	Bacteriology, NIH	5 days	Bacteriology Request Form

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
Chikungunya RT-qPCR	Blood	5-10 ml	EDTA tube	Virology, NIH	1 – 10 days	Virology Test Request Form
	Serum	1-3 ml	Plain tube			
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	2-4 ml	Plain sterile tube	Makmal Kesihatan Awam Kebangsaan	14 days	Laboratory Request Form For Dengue and Flavivirus
	CSF	Minimum 1 ml	Sterile Bijou bottle			
	Tissue Biopsy (Post mortem case)	1.5 cm ³ in a VTM	Sterile container			
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	1 – 3 ml	Sterile leakproof container	Virology, NIH	1 – 10 days	By appointment Reach lab within 12 hours after collection Virology Test Request Form
	Stool	> 5 gm (thumb size)				
	BAL/ Sputum/ NPA	3 ml				
	Organ Biopsies	About 1.5 cm cubes from various parts of affected organs				

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
	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	2.5 ml	EDTA tube	Parasitology, NIH	7 days	Blood taken between 6pm-12am General PER-PAT Form
	Blood on slides or filter paper		Slide mailer or seal plastic bag			
Filariasis Serology	Blood	2 ml	EDTA tube	Parasitology, NIH	1 day	General PER-PAT Form
	Serum	2 ml	Plain tube			
Fungal PCR	Blood	2 ml	EDTA/ Plain tube/ Blood culture bottle	Bacteriology, NIH	14 days	Mycology Request Form
	Tissue CSF Sterile body fluids		As much as possible			
Hepatitis C Virus (HCV) RNA PCR Genotyping (Qualitative)	Blood	5 ml	EDTA tube	Virology, HKL	30 days	Transport in ice General PER-PAT Form

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
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	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 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

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
						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)
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

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
Japanese encephalitis (JE) RT-qPCR	Serum	1-3 ml	Plain tube	Virology, NIH	5 days	Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK
	Plasma	1-3 ml	EDTA tube			
	CSF	1 ml	Sterile container			
	Organ biopsies	1.5 cm ³ from various parts of affected organs	Sterile containers containing VTM			
Japanese encephalitis serology	Serum	2-4 ml	Plain tube	Makmal Kesihatan Awam Kebangsaan	7 days	Samples should be collected within 5 days from onset of illness Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK
	CSF	1 ml	Bijou Bottle			
Leishmaniasis Serology	Serum	2	Plain tube	Parasitology, NIH	5 days	General PER PAT Form
	Blood	2-3 ml	EDTA tube			
Leptospira Culture	Whole blood	One or two drops (~50 microlitre)	Container must get from NIH	Bacteriology, NIH	21 days	Leptospirosis Laboratory Request Form
		5 ml	Heparin tube			
Leptospira PCR	Blood	2-3 ml	EDTA tube	Microbiology, NIH	6 days	Send before start antibiotic Leptospirosis Laboratory Request Form
	Sterile body fluid/ Tissue	2-3 ml	Sterile container			
Leptospiral Micro-Agglutination 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

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
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
	NPA/ Tracheal aspirate	NPA/TA: 1-3 ml				
	Throat swab		VTM			
Monkeypox qPCR	Lesion Fluid Aspirate	0.5 - 1 ml	Lesion aspirate/ roof: Sterile leakproof screw capped 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 Naso- pharyngeal 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	3 - 5 ml	Sterile plain container	Makmal Kesihatan Awam Kebangsaan	49 working days	Daily (Office Hour) Borang Permohonan
	CSF Pus Body fluids	CSF/ fluid/ pus: 1 - 2 ml				

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
						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
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 CSF Organ biopsies	2 – 4ml 1 – 3ml 1.5 cm cube in VTM	Leak-proof Sterile container	Makmal Kesihatan Awam Kebangsaan	3 days	Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
Panel Anti Ganglioside Antibodies	Serum	5 ml	Plain tube	Autoimmune, NIH	14 days	Autoimmune Request Form
	CSF	At least 1 ml	Bijou bottle			
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	3 - 5 ml	Plain tube	Autoimmune, NIH	14 days	Autoimmune Request Form
	CSF	1 ml	Bijou bottle			
Panel Tissue Autoantibodies: (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	3 ml	Plain tube	Makmal Kesihatan Awam Kebangsaan	3 days	Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK
	CSF	1 ml	Sterile plain container			
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/ Naso-pharyngeal aspirate/ Sputum/ Tracheal aspirate/ Broncho-Alveolar lavage	1 - 3ml	Sterile Leakproof 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
	Naso-pharyngeal 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	Rickettsia 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 Immunoglobulin 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	Sterile bottle	Makmal Kesihatan Awam Kebangsaan	4-6 weeks	General PER PAT Request Form

Test	Specimen	Volume	Sample Container	Perform Site/ Referral Lab	Referral Lab TAT	Special Requirement/ Forms
		Others: Not applicable				
Zika virus qRT PCR	Serum	2 - 4 ml	Plain tube with serum separator	Makmal Kesihatan Awam Kebangsaan	3 days	Borang Permohonan Ujian Makmal (Spesimen Klinikal) MKAK
	CSF	1 ml	Sterile screw capped container			

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 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

Forms	Code	Description
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

INTRODUCTION

All histopathology and cytology samples are referred to referral laboratories.

HISTOPATHOLOGY EXAMINATION (HPE)

List of Services

- Surgically and non-surgically removed tissue
- 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 PathText 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

The screenshot displays a laboratory information system (LIS) interface. On the left, there are search filters for 'Period From' (set to 17/07/2024 10:31), 'Flow Sheets', 'Encounter ID', and 'Display By Event'. Below these is a table with columns for 'Event' and 'Value'. The table lists various hematology tests such as 'Percentage Of Eosinophil', 'Absolute Neutrophil', and 'Nucleated Red Blood Cells%'. A section titled 'Histopathology' is expanded to show 'Clinical History' and 'SP Tonsil/adenoid (Biopsy)'. A 'View Image' link is visible under the biopsy entry. On the right, a pop-up window titled 'Specimen Image -- Webpage Dialog' is open, showing a table with columns: 'Test', 'Sample ID', 'Anatomy', 'Tissue Description', and 'View'. The table contains two rows of data for 'FPP SP Tnsil Bo' with sample IDs 'A' and 'B', both with 'Tonsil/adenoid' anatomy and 'Tonsil, Rt' and 'Tonsil, Lt' tissue descriptions. A 'View Image' link is present for each row.

Test	Sample ID	Anatomy	Tissue Description	View
FPP SP Tnsil Bo	A	Tonsil/adenoid	Tonsil, Rt	View
FPP SP Tnsil Bo	B	Tonsil/adenoid	Tonsil, Lt	View