

DEPARTMENT OF PATHOLOGY



Hospital Pulau Pinang

USER MANUAL

7th edition (2025)



KEPENTERAN KESIHATAN
MALAYSIA

HOSPITAL PULAU PINANG

**DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG**

**USER MANUAL
7th edition (2025)**

Foreword by the Hospital Director



It is a distinct honour to introduce the revised edition of the “Department of Pathology User Manual 7th edition”, an extensively updated and meticulously reviewed version of the previous 2020 issue.

Pathology remains a cornerstone of modern healthcare systems, playing a crucial role in diagnosis and treatment. This manual is designed to serve as an invaluable resource for all healthcare professionals involved in laboratory services. We trust that this updated edition will enhance accessibility and provide significant benefits to its users.

I would like to extend my heartfelt congratulations to the Head of Department, the Technical Training Committee, the Editorial Committee, and all dedicated staff members in the Department of Pathology. Your collective hard work and commitment have been instrumental in the successful realization of this comprehensive revision.

May this manual continue to support and inspire excellence in pathology practices, contributing to the broader mission of improved healthcare outcomes for all.

Warm regards,

Dr. Goh Hin Kwang

Hospital Director

Hospital Pulau Pinang

Foreword by the Head of Pathology Department



This manual is designed to provide a guide to Biochemistry, Haematology, Anatomical Pathology and Microbiology services offered by the Pathology Department of Penang Hospital. It contains the latest laboratory test menu in Penang Hospital as well as comprehensive details of specimen containers with special instructions regarding tests performed in the laboratory and also those outsourced.

This is the seventh edition of the user manual since it was first published in 1996. A great demand for it has encouraged the department's technical training committee to update the edition every 4 years or whenever necessary. This manual is uploaded in the Penang Hospital website to ensure accessibility to all users of the laboratory services. I hope this manual will be a valuable reference to our clients. We also welcome and appreciate constructive comments and suggestions for future improvements. This will enhance our programmed of continuous review and upgrade of laboratory work to reflect changing clinical practice and demands.

I would like to express my appreciation and congratulations to the members of the editorial board, heads of the laboratory units and all those who help to compile and revise this manual.

Thank you

*Dr. Ida Marhainis Isahak
Head of Pathology Department
Hospital Pulau Pinang*

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User Manual
Committee Member**

Seventh Edition, 2025

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To all past and present personnel in the Pathology Department who have contributed directly or indirectly in the making of this manual.

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CHAPTER I:

GENERAL INFORMATION

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INTRODUCTION

Department of Pathology Hospital Pulau Pinang comprises of Chemical Pathology, Microbiology, Haematology, Histopathology, Cytopathology, and Referral laboratory and Main Counter unit.

VISION

The Department of Pathology will work towards achieving the highest possible quality work output with speed, accuracy and precision to meet the requirement of patient management.

MISSION

The Department of Pathology will emphasize on the enhancement of productivity through dedicated teamwork and to provide an efficient and effective quality service, which is dynamic and responsive to the needs of the clinicians in the diagnosis and management of patients. To uphold this, continuous manpower and skill development is emphasized with optimum use of the available technology.

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DEPARTMENT OF PATHOLOGY

OBJECTIVE

The laboratory had designed the following quality objectives that are measurable and consistent with the quality policy of the organization.

1. To achieve the laboratory turn-around time (LTAT) for tests result according to the Customer Charter of each unit concerned.
1. To meet the requirements of NIA standards.
2. To meet the requirements of KPI and HPIA standards.
3. To achieve < 1% for Rejection rate of samples.
4. To achieve > 80% of personnel attended 7 days of training per year or as specified by HPP.
5. To conduct an Internal Audit annually.
6. To conduct customer satisfaction survey annually.
7. To achieve 90% of equipment undergoes scheduled verification / calibration.
8. To achieve > 80% satisfactory results in the participated EQA programs by respective units.

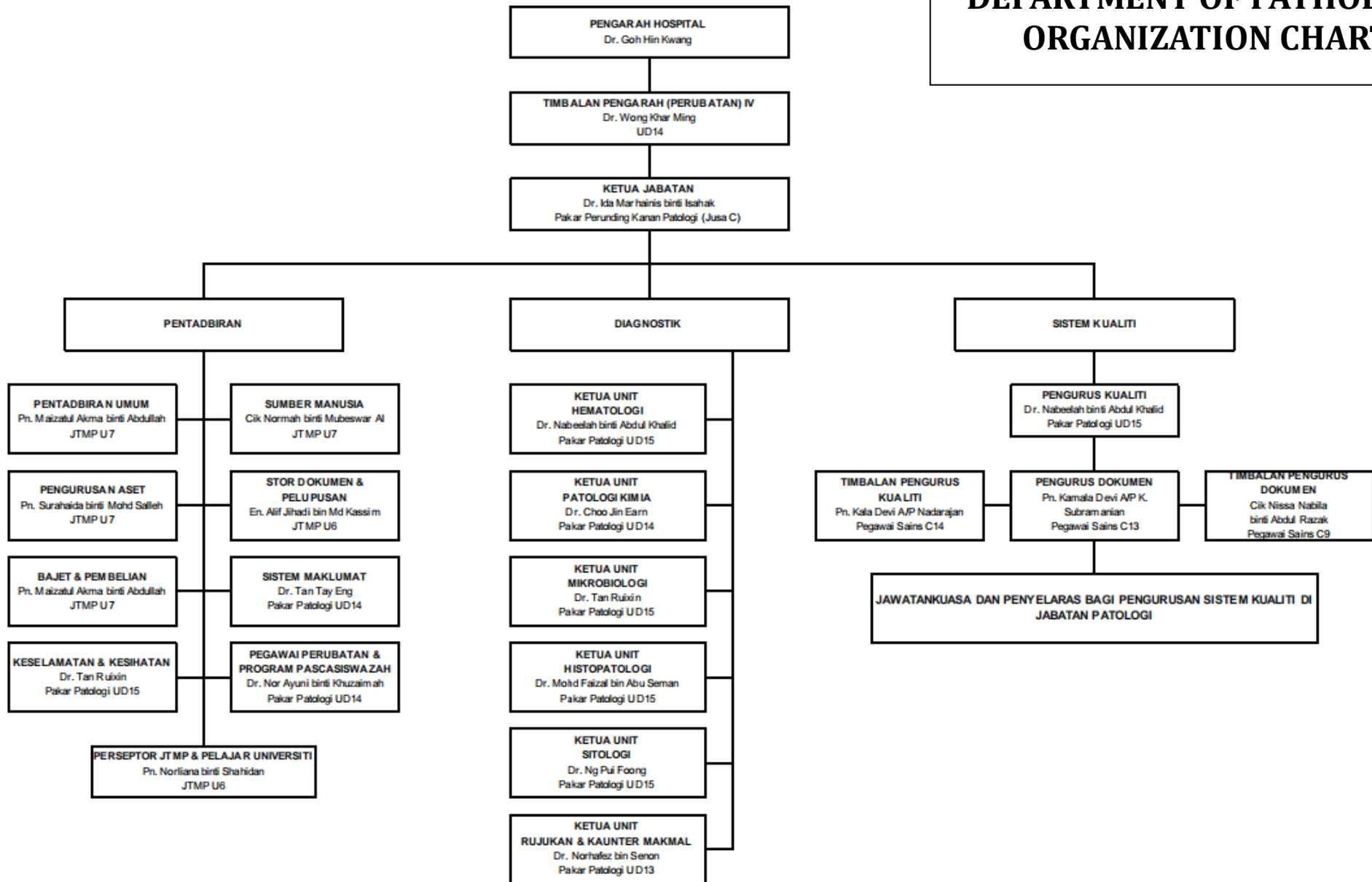
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DEPARTMENT OF PATHOLOGY

CUSTOMER CHARTER

1. To deliver high-quality professional services to all stakeholders and customers.
2. To provide a comprehensive explanation of laboratory tests to clients when required.
3. To deliver all URGENT test results within the stipulated laboratory turnaround time (LTAT).
4. To carry out laboratory work effectively, efficiently and accurately.
5. To provide effective and specialized laboratory training to medical doctors, scientific officers, medical laboratory technologists and other allied health care workers.

DEPARTMENT OF PATHOLOGY ORGANIZATION CHART



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LIST OF TESTS PROVIDED

- List of tests available at Pathology Department, Hospital Pulau Pinang is given in [Appendix I](#).
- List of tests to the referral laboratory can be found in the [HPP OUTSOURCE TEST LIST](#) (<http://10.158.101.68:8056/testlist/>).

LOCATION

- The Department of Pathology is located at Ground Floor (009), Block B of Hospital Pulau Pinang.
- The Cytopathology laboratory is located at the Outpatient Department (001).
- The TB laboratory is located on the 2nd floor adjacent to Chest Clinic, Block B.

BUSINESS HOUR

Day	Shift	
	Morning	Afternoon
Monday - Thursday	8.00 am – 1.00 pm	2.00 pm – 5.00 pm
Friday	8.00 am – 12.15 pm	2.45 pm – 5.00 pm

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24 HOURS SERVICE

Units which provide 24 hours services are: -

1. Chemical Pathology Laboratory
2. Microbiology Laboratory
3. Haematology Laboratory

AFTER OFFICE HOUR/PUBLIC HOLIDAY

1. Urgent tests will be run on the day of receipt of request and results will be released according to the stipulated LTAT as stated in [Appendix I](#).
2. For non-urgent requests received after office hour will be run as per stipulated in Appendix I.
3. Pathologist on call is contactable for any problems encountered during and after office hours.

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COMMUNICATION

Contact numbers for Department of Pathology Hospital Pulau Pinang

Unit	Personnel / Location	Ext.
Office	Consultant Pathologist & Head of Pathology Department	5148
	Senior Medical Lab Technologist	5018
	Department Reception Counter	5147
	General Pathology Office	5145
Microbiology	Bacteriology Laboratory	5152/5153
	Clinical Microbiologist	5490
	Senior Microbiologist	5490
	Serology	5987
	Senior MLT	5987
	Serology Laboratory	5987
	Molecular Diagnostic Laboratory	5220
	TB Laboratory	5216
Chemical Laboratory	Chemical Pathology Laboratory	5156/5159
	Chemical Pathologist	5158
	Senior Biochemist	5158/5650
	Biochemist	5158/5159
	Biochemist (Special Lab Chemical Pathology)	5651
	Senior MLT (Chemical Pathology Lab)	5156
	Special Chemical Pathology Laboratory	5651
	Clinical Laboratory (OPD)	5264
	Antenatal Clinical Laboratory	5374

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Referral Laboratory	Laboratory	5638
Main counter	Main counter	5147
Histopathology & Cytopathology	Histopathology Laboratory	5101
	Histopathologist	5480/5149
	Senior MLT/ Officer in Histopathology	5101/5054
	Cytology Laboratory	5650
	Pathologist in Cytology	5262
	Senior MLT/Officer in Cytology	5650
	Haematology	Haematopathologist
Routine Haematology Laboratory		5146
Special Haematology Laboratory		5652
Medical Officers		5639/5388

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REQUEST FOR PATHOLOGY SERVICES

1. Request can be made using PER-PAT 301, unless as specified in the table for list of tests. Please use a separate request form for test done in different Pathology units.
 2. All request form should be written clearly and legibly.
 3. Other types of forms for specific tests are to be referred to [HPP OUTSOURCE TEST LIST](#).
 4. Details on patient information that must be included are:
 - a. Complete patient's name
 - b. For newborn/baby without name:
 - i. Please write "B/O" and indicate 1st, 2nd and so on for twins, triplets and so on.
 - ii. Please write down the **date of birth** and **gender** of baby.
 - c. Use complete 12 digits Identity Card no., Police or army no., passport no. for non-citizen, hospital registration number (RN). Use mother's or father's identity card number for babies.
 - d. Age, sex and race.
 - e. Source of request.
 5. Clinical summary for appropriate test requested.
 6. Name of test requested (clearly spelled out for rare test; do not use abbreviation).
 7. Name and signature of the requesting medical officer/specialist and stamp accordingly.
 8. Date and time of specimen collection.
 9. Requests for add-on tests by verbal communication will only be accepted within designated timeframes. For further details, please contact the relevant units.
- ❖ For urgent test requests, which are required for immediate patient management please use **GREEN** coloured PER-PAT 301 request form.
 - ❖ For test under research, the test request should use **PINK** coloured PER-PAT 301 request form and indicate name of research or study involved.

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RESEARCH COLLABORATION REQUESTS

- The Pathology department welcomes research projects or studies to be done in collaboration with our units.
- The requesting doctor should communicate directly with the Pathologist concerned.
- The requesting specialist needs to fill up a REQUEST FOR PATHOLOGY RELATED MATERIAL form (HPP/PAT/SD/216) which is available at the main office of pathology department.
- All collaborative studies or research projects must have approval from the Head of Pathology Department.
- A copy of the research proposal must be provided.
- One pathologist from the unit shall be appointed by Head of Pathology Department as collaborator or co-researcher.
- The researcher will be assisted by the appointed Pathologist to retrieve the materials required if the research project requires archival material from this unit.

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HPP/PAT/SD/216

REQUEST FOR PATHOLOGY RELATED MATERIAL
DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG

A) TO BE FILLED BY REQUESTER

TYPE OF MATERIAL: _____
Laboratory accession number: _____
Diagnosis: _____

REASON FOR REQUEST :

1. Research : YES/NO ; Topic : _____
2. Dissertation : YES/NO ; Title : _____
3. Publication : YES/NO
Type of publication : _____
Journal : _____
4. Presentation : YES/NO ; Type of Presentation : Oral/Poster
Conference details : _____
Conference dates : _____
5. Case reports for Masters program : YES/NO

If the case is going to be published/presented the Officer has to be notified and included as part of the authors.

REQUESTED BY :

Name : _____ Signature : _____
Department : _____ Date : _____
Designation: _____ Contact Number : _____
E mail address : _____

Name of consultant in-charge : _____ Signature : _____
Contact Number : _____ Date : _____
E mail address : _____

B) TO BE FILLED BY PATHOLOGY DEPARTMENT

PATHOLOGIST/OFFICER IN CHARGE (to be appointed by the Head of Department) :

Name : _____

HOD Name and Signature : _____ Date : _____

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HPP/PAT/SD/216

C)

Material received by requester

Name : _____ Signature : _____

Date : _____

Material given by

Name : _____ Signature : _____

Date : _____

**Two copies of the request forms shall be made: one copy to the relevant unit and the other to the department*

Procedure for Research related Requests and Research Collaboration between Department of Pathology and Other departments in Hospital Pulau Pinang.

A) Request for data, macroscopic/microscopic images/slides/specimens for poster/oral presentation and case reports :

- The requesting doctor will have to fill the "The Request for Pathology material form" as attached (HPP/PAT/SD/216).
- All presentations must include the relevant pathologist/officer name.

B) Research requiring pathology services/support :

1) New studies :

- A letter informing the Head of Pathology should be sent stating information on the research and the pathology services that are required.
- A pathologist or scientist (appointed by the Head of Department) from the relevant unit will be assigned to the particular research.
- It is advised that this pathologist/officer be involved in the discussion of the study protocol development before submission for approval.
- The study protocol and NMRR approval to be attached to the request form.

2) On-going research :

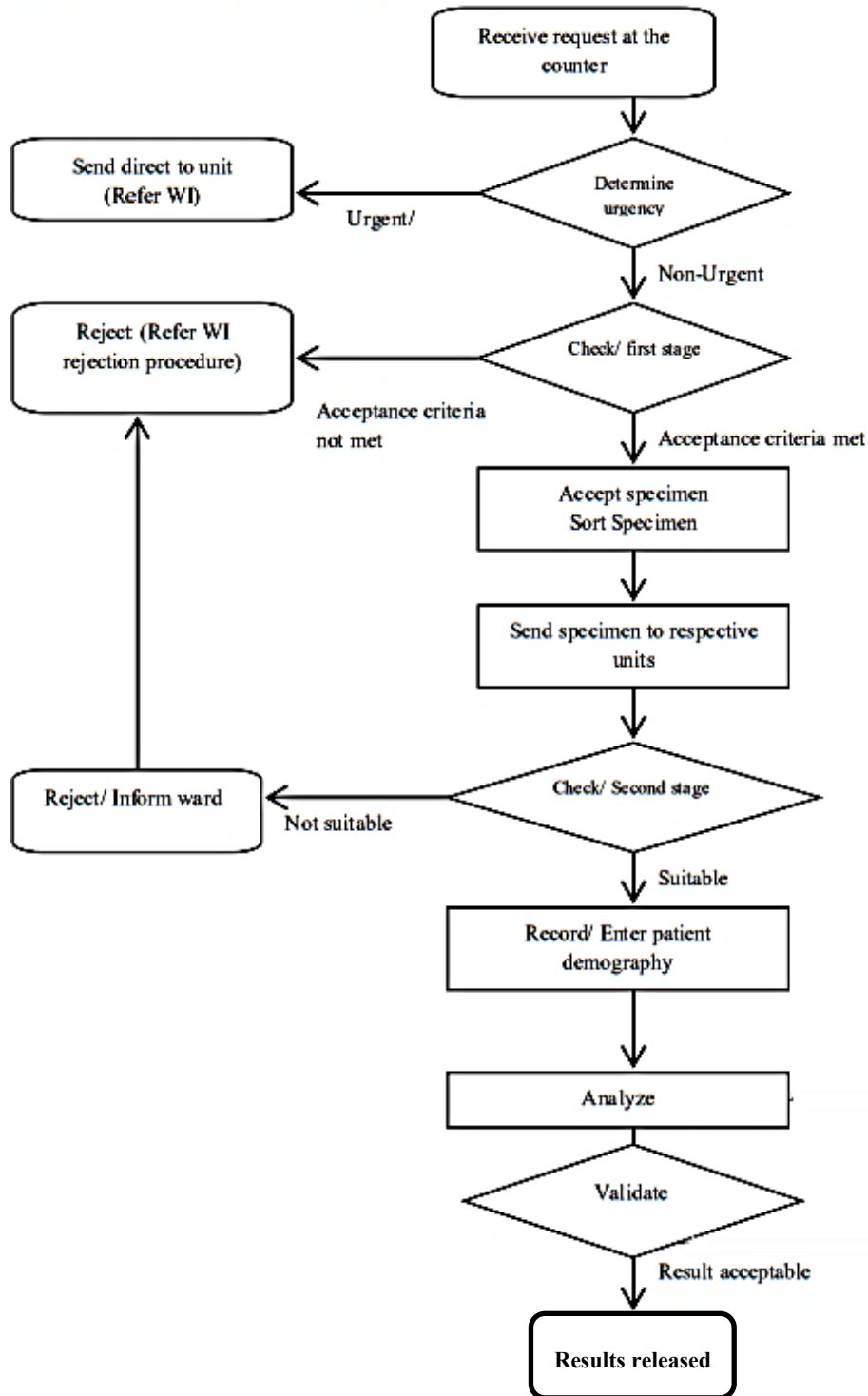
- Request for pathological tests needed for studies should be use the PINK PER PAT 301 form.
- The name of the study and the contact person's details should be mentioned on the PER PAT form.
- For on-going research, a letter with details as in new research should be sent.

C) Publications/Poster/Oral presentations should include the relevant pathologist names or at least acknowledgement of the Department of Pathology.

- A copy of the abstract/Publication needs to be given to the CRC liaison officer from pathology department

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LABORATORY WORKFLOW



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SPECIMEN COLLECTION

1. For the specimen that is collected in the wards/clinics, refer to the relevant test for proper specimen collection procedure (where indicated). This is also to ensure time of collection, receipt in the laboratory, temperature interval, and integrity of sample (e.g. use of preservatives) is appropriate for the requested test.
2. Preanalytical factors, encompassing everything before the sample reaches the laboratory for analysis, can significantly impact the accuracy and reliability of blood test results. These factors can introduce errors that lead to misinterpretations and potentially affect patient care. Refer the Appendix II for details.
3. Clear instruction is to be given to the patient if the specimens need to be collected by the patient (e.g. urine, sputum etc.)
4. Specimens should be clearly labelled with name, I/C No., time, date and test requested.
 - A positive patient identification process is needed to correctly identify patients thus avoiding medical error.
 - The phlebotomist shall ensure that the patient is correctly identified by:
 - a. Asking the patient to state their full name and IC number (use of at least 2 identifiers) in open ended questions such as “Can you tell me your full name and IC number?”.
 - b. Check the answers given against the information stated on the patient’s identification wristband and/or case notes.
 - c. Only one patient shall be attended to at any one time till completion.
 - d. The phlebotomist shall clearly and accurately label the blood sample at the patient’s bedside immediately after blood taking.
5. Multiple specimens from the same patients are to be put in a biohazard bag and attached with the request form if all the requests are performed by the same unit.

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6. Transportation of specimens:
 - All specimens should be treated as biohazard and to be dispatched to the laboratory as soon as possible. **PLEASE DO NOT KEEP THE SAMPLES IN REFRIGERATOR.**
 - Please refer to the specific test that requires special transportation procedures.
 - If the integrity of the sample is compromised with the possibility of health risk, the customer will be notified immediately, and appropriate action shall be taken to reduce the risk and prevent recurrence.
 - All referred tests are subjected to the respective service agreements between Hospital Pulau Pinang and external customers (HPP/PATr/QP/02 - Appendix I).
7. All specimens are to be sent to the main reception counter in the Department of Pathology during office hours except for Histopathology and Cytopathology specimen. Please send all Histopathology and Cytopathology specimen directly to their respective units.
8. Supplies of tubes and containers:
 - Please contact the Main Reception Counter at Ext. 5147.

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BLOOD COLLECTION PROCEDURE

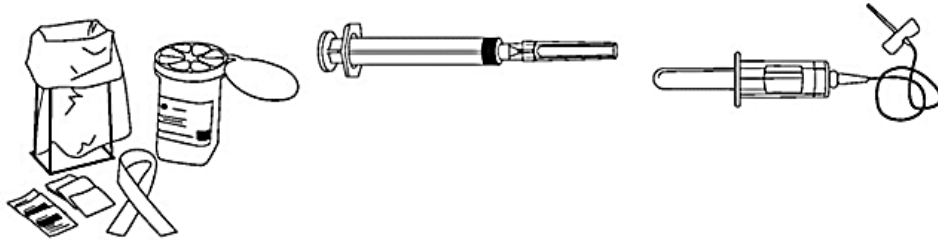
1. Assemble equipment.
2. Perform hand hygiene.
3. Identify and prepare the patient.
4. Select the site, preferably at the antecubital area (i.e. the bend of the elbow).
5. Apply tourniquet (about 4-5 finger widths above the venipuncture site).
6. Ask the patient to form a fist so that the veins are more prominent.
7. Put on well-fitting gloves.
8. Disinfect the venipuncture site with 70% isopropyl alcohol for 30 seconds and allow it to dry completely (around 30 seconds).
9. Anchor the vein by holding the patient's arm and place a thumb below the venipuncture site.
10. Enter the vein swiftly at 30° angle.
11. Once sufficient blood has been collected, release the tourniquet before drawing the needle.
12. Withdraw the needle gently and then give the patient a clean gauze or dry cotton-wool ball to apply to the site with gentle pressure.

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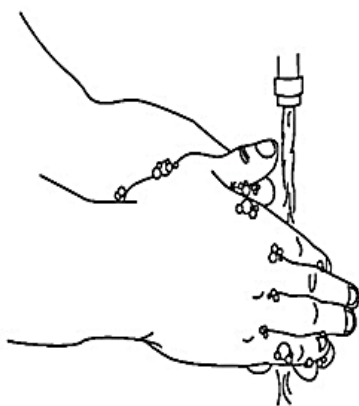
13. Pierce the stopper on the tube with the needle directly above the tube using slow, steady pressure. Do not press the syringe plunger because additional pressure increases the risk of haemolysis. Allow the tubes to be filled directly by the vacuum inside the vacutainer tube.
14. If a non-vacutainer tube is being used, allow the blood to fill the collection tube by using a slow and steady pressure until the blood fills the fill line.
15. Gently mix the blood collection tube by inverting 8-10 times immediately after collection.
16. Discard the used needle and syringe or blood-sampling device into sharp bin.
17. Check the label and forms for accuracy.
18. Remove gloves and perform hand hygiene.

Reference: WHO guidelines on drawing blood: best practices in phlebotomy, 2010

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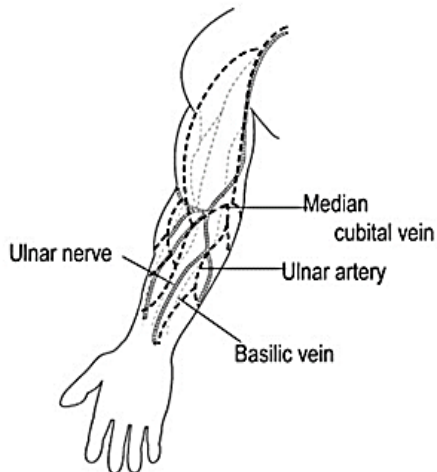
1. Assemble equipment and include needle and syringe or vacuum tube, depending on which is to be used.



2. Perform hand hygiene (if using soap and water, dry hands with single-use towels).



3. Identify and prepare the patient.



4. Select the site, preferably at the antecubital area (i.e. the bend of the elbow). Warming the arm with a hot pack, or hanging the hand down may make it easier to see the veins. Palpate the area to locate the anatomic landmarks. **DO NOT** touch the site once alcohol or other antiseptic has been applied.



5. Apply a tourniquet, about 4–5 finger widths above the selected venepuncture site.

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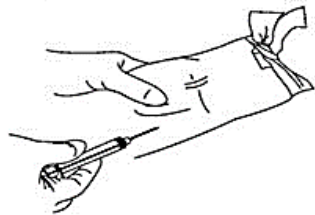
6. Ask the patient to form a fist so that the veins are more prominent.



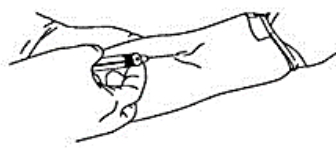
7. Put on well-fitting, non-sterile gloves.



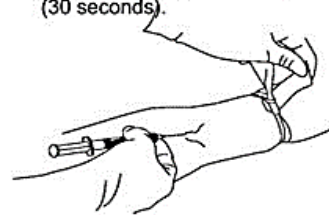
8. Disinfect the site using 70% isopropyl alcohol for 30 seconds and allow to dry completely (30 seconds).



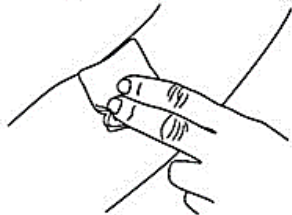
9. Anchor the vein by holding the patient's arm and placing a thumb BELOW the venepuncture site.



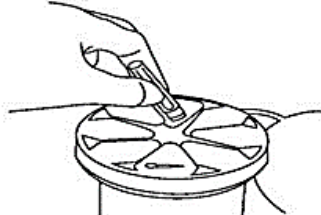
10. Enter the vein swiftly at a 30 degree angle.



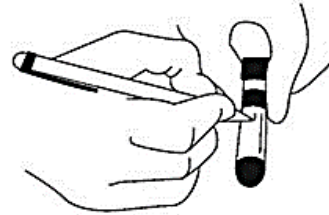
11. Once sufficient blood has been collected, release the tourniquet BEFORE withdrawing the needle.



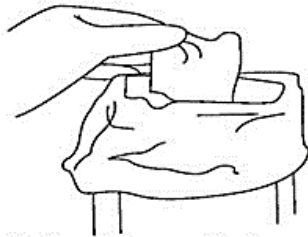
12. Withdraw the needle gently and then give the patient a clean gauze or dry cotton-wool ball to apply to the site with gentle pressure.



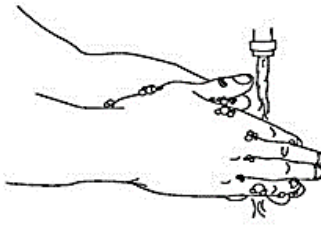
13. Discard the used needle and syringe or blood-sampling device into a puncture-resistant container.



14. Check the label and forms for accuracy.



15. Discard sharps and broken glass into the sharps container. Place items that can drip blood or body fluids into the infectious waste.

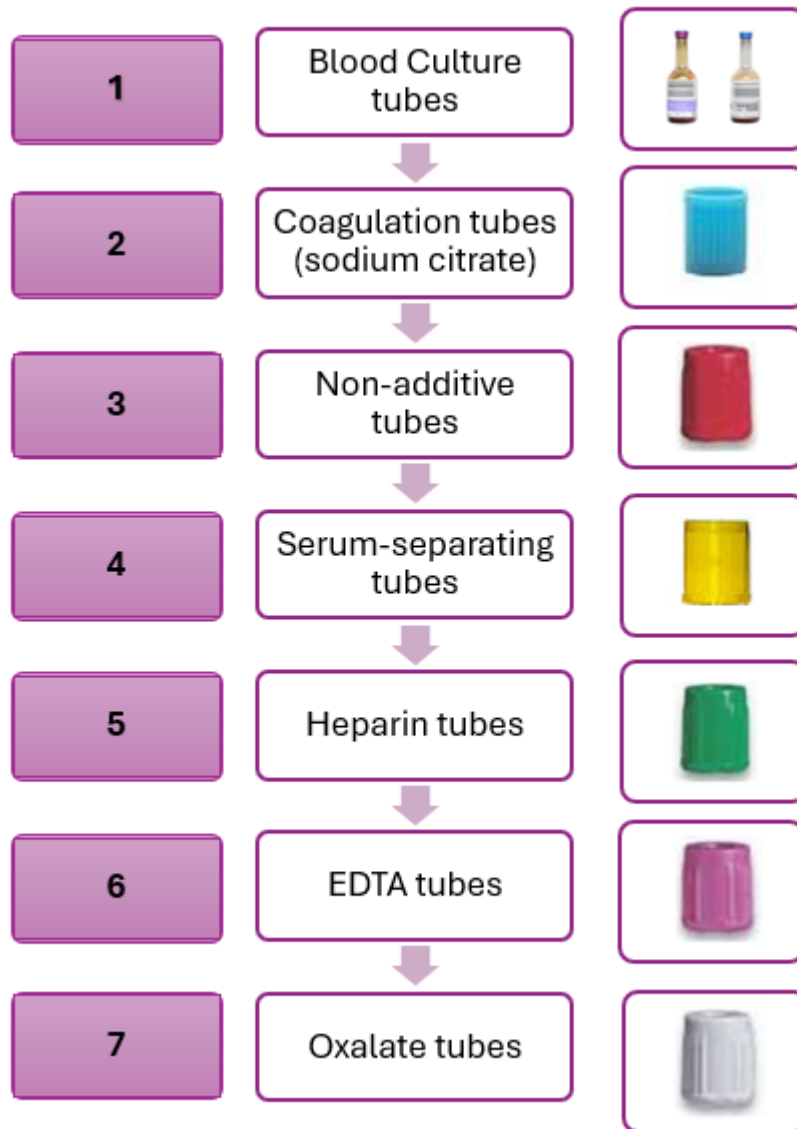


16. Remove gloves and place them in the general waste. Perform hand hygiene. If using soap and water, dry hands with single-use towels.

Reference: WHO guidelines on drawing blood: best practices in phlebotomy, 2010

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ORDER OF BLOOD DRAW



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NEEDLE STICK INJURY (NSI)

1. **Must inform the lab immediately** before sending the samples at ext. 5987 (during office hours) or ext. 5152/5153 (after office hours).
2. The **blood specimen** must be **sent in pairs** (except for cases with unknown source) and note on the form whether it is **victim / staff or patient /source**.
3. Please state the status of NSI case (review or new case).
4. HIV Ag/Ab combo, HBsAg, Anti-HCV will be done within 1 working day if the sample is received during office hour.
5. After office hour, only HIV and HBV rapid test will be done. HIV Ag/Ab combo, HBsAg, Anti-HCV will be tested on the next working day.
6. The result of the new case will be informed to the Infectious Disease (ID) clinic.

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REJECTION CRITERIA

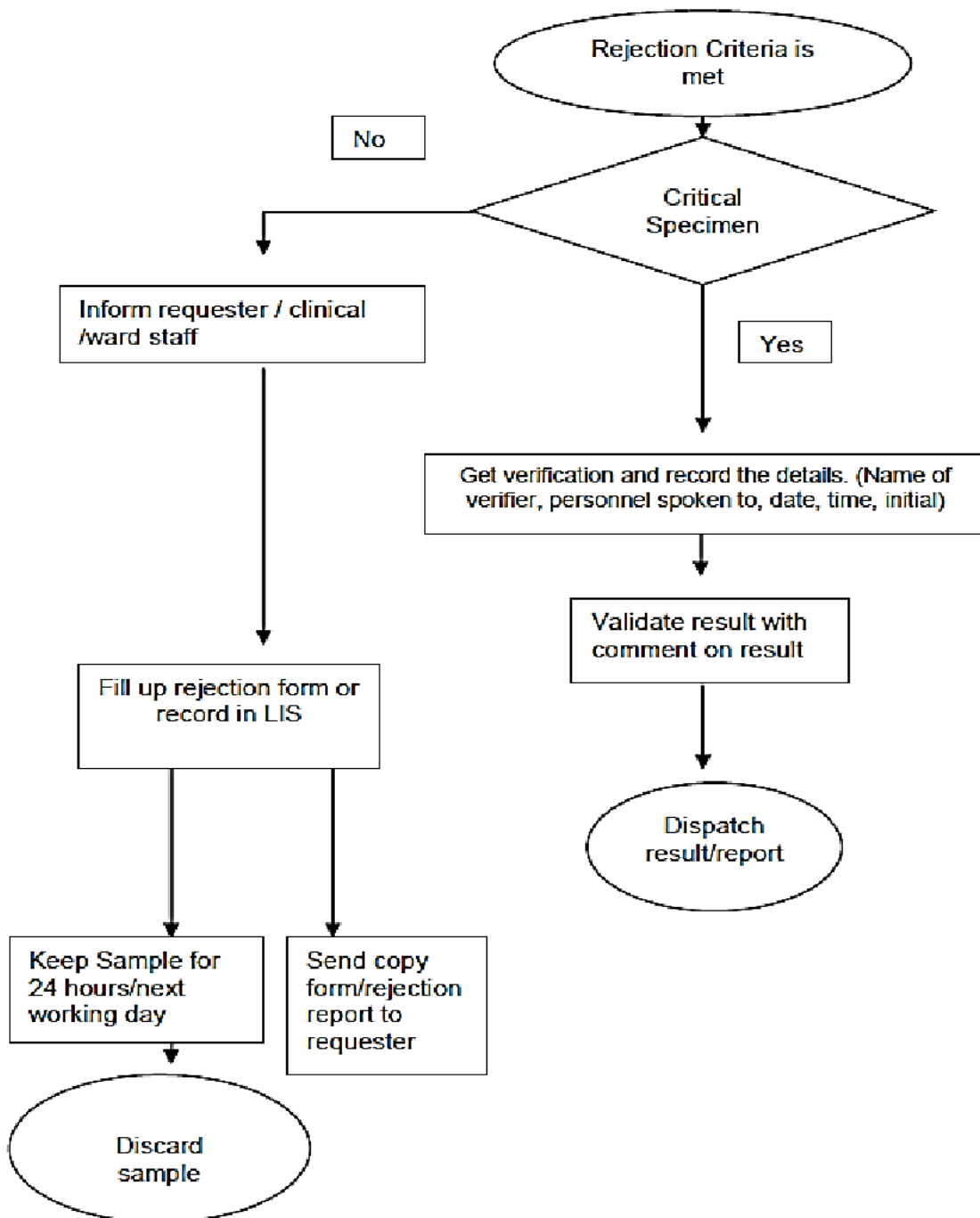
1. No name on the form / specimen.
2. Incomplete IC and RN.
3. Requesting Hospital / Unit / Ward / Clinic not identified.
4. No requesting doctor's name/rubber stamp.
5. Broken / leaking container.
6. Blood is haemolysed / clotted.
7. No form / specimen received for request.
8. Insufficient or excess specimen sent for analysis.
9. Specimen is collected in wrong container.
10. Mislabeled of specimen / form.
11. No test indicated.
12. No date/time of specimen collection/dispatch, no name/signature of dispatch personnel. *
13. No/inadequate clinical summary.
14. No routine screening unless blood donors / organ donors and recipients.
15. Test/s is not available or not offered in KKM laboratory.
16. Specimen is unsuitable for analysis.
17. Others

★ Criteria no. 12 is applicable for certain/relevant test only (Please refer to respective unit).

❖ Specimen which does not fulfil the criteria for specimen collection, dispatch and transportation will be rejected except for precious or irreplaceable specimens (eg tissue biopsy, CSF samples). These samples will be accepted at the discretion of the pathologist in charge.

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REJECTION FLOW CHART



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RESULT

FOR CRITICALLY ABNORMAL RESULTS

- All critically abnormal results will be informed via phone, and a report will be released via the hospital intranet web-based [Sistem eResults Jabatan Patologi](http://10.158.109.9/) (http://10.158.109.9/).
- The laboratory staff will escalate to the pathologist on-call when the responsible person to receive the result/report cannot be contacted.

FOR ROUTINE REQUEST

- The results are available for viewing in the web-based [Sistem eResults Jabatan Patologi](#) (e.g., FBC, Blood gases).
- Reprint of results will only be issued to the requesting doctors through medical staff upon request, or when necessary.
- Confidential result will be printed and issued to the requesting doctor accordingly.

NOTIFICATION OF DELAY OF EXAMINATION/RESULT

- Laboratory will notify the client if there is any significant delay to the examination or result which could compromise patient care via:
 1. [Sistem eResults Jabatan Patologi](#)
 - The notification on the specific test result or on the main web.

OR

2. Memo / Letter
 - Official memo or letter to be issued to the relevant department / clinic / ward.

Please contact the laboratory for further clarification shall there be any enquiry.

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COMPLAINT PROCEDURE BY CUSTOMER

1. Any complaint regarding laboratory's services shall be made through the following procedure:

A. Laboratory User

- i. By filling up the form (HPP/PATr/QP/06 Appendix 1) obtained from the Department of Pathology or from the [Sistem eResults Jabatan Patologi](#) (BORANG ADUAN JABATAN PATOLOGI HOSPITAL PULAU PINANG).

OR

- ii. Contact the laboratory to lodge a verbal complaint.

***Laboratory user** is an individual or entity that requests the laboratory service (clinicians, other laboratories or institutions that send the samples for examination).

B. For Patient

- i. By filling up the *Borang Aduan* at the *Seksyen Perhubungan Awam*, 3rd Floor, ACC, Hospital Pulau Pinang.

OR

- ii. By making phone call to *Seksyen Perhubungan Awam* Hospital Pulau Pinang (04-2225947 / 5116).

2. The laboratory shall acknowledge receipt of complaint within 3 working days and provide the complainant with the resolution of the complaint within 7 working days.

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CONFIDENTIALITY

MANAGEMENT OF INFORMATION

- i. Laboratory collects adequate information which enables laboratory examinations to be carried out but does not collect unnecessary personal information.
- ii. Patient's confidentiality is always preserved. Results will normally be reported to the requesting doctor and may be reported to other parties with the Patient's consent or as required by law.
- iii. Laboratory takes necessary steps to safeguard storage of information against loss, unauthorised access or tampering and other misuse.
- iv. The use of samples for purpose other than those requested without prior consent, occurs only if the residual samples are rendered anonymous or have been pooled.

RELEASE OF INFORMATION

- i. When the laboratory is required by law or authorized by contractual arrangement to release confidential information, the patient concerned shall be notified of the information released, unless prohibited by law.
- ii. Information about the Patient from a source other than the patient (e.g. complainant, regulator) shall be kept confidential by the laboratory. The identity of the source shall be kept confidential by the laboratory and shall not be shared with the patient, unless agreed by the source.

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REQUIREMENTS REGARDING PATIENTS

- ❖ Laboratory management will ensure that patient’s well-being, safety and rights are the primary considerations.
- ❖ The department will comply to the hospital’s policy on patient and family rights.
- ❖ The laboratory has established and implemented the following via Department of Pathology Hospital Pulau Pinang User Manual 7th Edition 2025 (HPP/PATr/MO43):
 - i. Laboratory user must provide useful information to aid the laboratory in the selection of examination methods via request form and proper interpretation of the examination results will be provided by pathologists / MO whenever necessary.
 - ii. Information about the laboratory turn-around time (LTAT) and frequency is indicated in the user manual.
 - iii. Any incidents that resulted or could have resulted in the patient harm and the action taken to mitigate those harms are recorded in the Risk Registry. This would be disclosed to laboratory user appropriately.
 - iv. The use of samples for purpose other than those requested without prior consent, occurs only if the residual samples are rendered anonymous or have been pooled. Appropriate procedures in place to ensure staff treat human samples, tissues or remains according to relevant legal requirements.
 - v. All procedures carried out require consent from the patient. Consent can be inferred when the patient willingly submits to the venepuncture. However special procedures including more invasive procedures such as FNAC and BMAT will require a written consent under clinicians’ responsibility.

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- vi. Ensuring the ongoing availability and integrity of retained patient samples and records in the event of the closure, acquisition or merger of the laboratory.
- vii. Making relevant information available to a patient (appropriately) and any other health service provider at the request of the patient or the request of a healthcare provider acting on the behalf.
- viii. The laboratory treats all patients fairly and without discrimination. Laboratory collects adequate information which enables laboratory examinations to be carried out but does not collect unnecessary personal information.
- ix. Adequate privacy during reception, sampling and counselling is available (if any).

PATIENT CONSENT

Consent for sample collection from patients are obtained in these circumstances:

- i. The consent is inferred once request forms with samples are received at the laboratory

OR

- ii. Written informed consent given by patients in certain/special procedures which are carried out in the laboratory (e.g., cryoglobulin test).

CHAPTER II:

MEDICAL MICROBIOLOGY

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MEDICAL MICROBIOLOGY

BACTERIOLOGY

GENERAL

1. Properly collected specimens should be sent to the laboratory during office hours without delay in order to avoid overgrowth of commensal or loss of viability of pathogens.
2. Specimens should be collected from correct anatomic sites using proper techniques to avoid contamination from indigenous flora.
3. Specimens should be collected before antibiotics are given, if possible. If antibiotics are given, indicate on the request form.
4. Specimens collected should be of adequate volume and be placed in appropriate containers.
5. Each specimen should be accompanied by a completely filled PER-PAT 301 request form.
6. Laboratory Turnaround time (LTAT) – please refer to the Microbiology Laboratory Customer Charter.

SPECIFIC REJECTION CRITERIA

Generally, any specimen which does not fulfil the criteria for specimen collection, dispatch & transportation will be subjected to rejection / hold on for verification.

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SPECIMEN COLLECTION

Collection of Cerebrospinal Fluid (CSF) for culture and sensitivity (C&S) or Bacterial Antigen Detection.

1. Disinfect the skin over the lumbar puncture site.
2. Observing aseptic techniques perform a lumbar puncture and collect about 3 – 4 ml of CSF in a sterile bijoux bottle/ **sterile** container.
3. Send the specimen at room temperature immediately to the laboratory. **DO NOT STORE IN A REFRIGERATOR**, as organisms causing meningitis are usually very sensitive to cold.

Other body fluids for C&S

1. Transfer pleural, pericardial, peritoneal, and synovial fluids aspirated aseptically to a **sterile** screw capped bottle and send to the laboratory without delay.
2. If delay is unavoidable, **store at room temperature** and send to the laboratory within 24 hours after collection.

Ear Swab

1. The external meatus is cleaned with a dry swab moistened with sterile saline. Let the site dry before sampling.
2. Pass a **sterile** swab gently into the external canal and collect whatever exudate is found there.
3. Place the swab in its carrier-tube or transport media and send the specimen to the laboratory as soon as possible.

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Eye Swab

1. Collect the eye exudates with **sterile** swabs. If swabs of both eyes are needed, please use separate **sterile** swabs.
2. Place the swab into a transport medium and send it together with a fixed smear of the exudates to the lab.
3. For the isolation of *Neisseria gonorrhoeae*, inoculate the specimen onto a GC+LCAT Agar plate in a 'Z' fashion at the bedside and send the plate immediately to the laboratory. Please state the pathogen interested specifically on the request form.

Stool

Note: Bedpans should be cleaned before specimen collection.

I. Fresh stool

1. Using a **sterile** swab, collect a small amount of stool, by dipping and rotating in the faeces, taking care to include materials containing pus, mucus or blood if present.
2. Place the swab with the stool into a sterile universal container, screw the cap tightly and send it immediately to the laboratory.
3. If delay is unavoidable, store at 4⁰C in respective ward and send to the laboratory within 24 hours after collection.
4. For isolation of *Vibrio cholerae* and *Campylobacter jejuni*, please state the pathogen interested specifically on the request form and inform the Bacteriology Laboratory at the ext. 5152.

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II. Rectal swab

Note: Rectal swab should only be taken for CRE / ESBL / MRO / VRE screening or if a stool specimen is not available. Rectal swab is a less satisfactory specimen than stool for isolation of enteropathogenic bacteria.

1. Insert a **sterile** swab deep into the anus 1 inch beyond the anus sphincter so that the swab may come into contact with some fecal material. A satisfactory rectal swab is one, which shows some fecal staining.
2. Send the specimen to the laboratory as soon as possible. Dip the rectal swab into the appropriate enteric transport medium as below: -

No.	Transport Medium	Organisms
a.	Amies Transport Medium	suitable for most enteropathogenic bacteria
b.	Selenite F Broth	specifically for <i>Salmonella</i> species & <i>Shigella</i> species
c.	Alkaline Peptone Water	for <i>V. cholerae</i> and other <i>Vibrio</i> species

3. Send specimen to microbiology laboratory as soon as possible.

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Blood C&S (Blood Culture Bottles)

Note: Only take blood for culture when there is a clinical indication and not as routine investigation.

Blood Volume Required

1. Adults: 5 – 10ml of blood in each bottle
2. Paediatric: 1 – 3ml of blood or $\leq 1\%$ of total blood volume
3. Myco F/Lytic: 1 – 5ml of blood
4. Both excessive and insufficient blood volume inoculated into the blood culture bottle/vial will reduce the sensitivity of the blood culture.

Number of Blood Culture Required

- Ideally ≥ 2 sets of blood cultures should be obtained from different venipuncture for each sepsis episode.

Timing of Blood Culture Collection

- Before administration of antimicrobial agents.

Site of Blood Culture Collection

1. Peripheral - preferable blood culture collection site
2. Intravenous catheter
 - a. Only when catheter related bloodstream infection is suspected
 - b. Must paired with peripheral blood culture simultaneously
 - c. Blood cultures should not be drawn through an intravenous catheter at the time of catheter insertion.
3. Do not use existing peripheral lines/cannula to obtain blood cultures.

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Types of Blood Culture Bottle/Vial

1. Aerobic bottle/vial: for isolation of aerobic bacteria from blood in adult.
2. Anaerobic bottle/vial: for isolation of anaerobic bacteria from blood in adult.
3. Paediatric bottle/vial: for isolation of bacteria from blood in paediatric patient.
4. Myco F/Lytic bottle/vial: for isolation of *Mycobacterium*, fungal pathogen from blood or body fluid specimen.
5. Paediatric bottle/vial should not be used for adult blood sample as smaller blood volume diminish the yield of pathogens.

Collection procedure

1. Blood culture must be collected using aseptic technique.
 - a. Check the blood culture vials for:
 - i. Expiry date
 - ii. Turbidity of the broth inside the vial - Blood culture bottle with gross turbidity should be returned to the lab.
 - b. Mark the vials at desired fill level.
 - c. Select the site of venipuncture.
 - d. Remove the plastic flip-off caps from the vials immediately before collecting the sample and clean the rubber septum on top of the bottle with 70% alcohol.
 - e. Perform hand hygiene and put on sterile PPE.
 - f. Skin preparation:
 - i. >0.5% chlorhexidine, tincture of iodine (if the patient is allergic to chlorhexidine), or 70% isopropyl alcohol (patients <2 months old) should be used to prepare the venipuncture site to reduce the presence of skin contaminants.

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- ii. Clean the intended venipuncture site in a circular pattern from inside to outside.
 - iii. Adequate drying time as follows must be allowed to reduce the likelihood of contamination:
 - Isopropyl alcohol: 0 seconds
 - Tincture of iodine: 30 seconds
 - Chlorhexidine: 60 seconds
 - Povidone iodine: 2 minutes
 - g. Perform venipuncture.
 - h. Inoculate the blood specimen into aerobic bottle first before inoculating the anaerobic bottle to avoid introduction of air into the anaerobic bottle.
 - i. Invert the bottles gently for a few times and keep the bottles upright
 - j. Label all the vials with:
 - Patient's name and identification number
 - Date, time, and source of collection
 - DO NOT write on or place any labels over the vial barcode, as this is used by the instrument to process the specimen
2. Transport to lab as soon as possible for incubation, if not, keep at room temperature for not more than 48 hours.

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Sputum for C&S

Sputum, expectorate

1. Collect the sputum specimen in early morning.
2. Ask patient to rinse and gargle mouth with water.
3. Instruct patient to take a deep breath and cough deeply to produce lower respiratory specimen and collect sputum in a **sterile** container.
4. Send specimen immediately to laboratory.

Nasal swab for C&S

1. Moistened the **sterile** swab with sterile saline before sampling.
2. Rotate the swab over the mucosa of the nasal cavity.
3. Insert the swab in its carrier-tube or transport media and send the specimen to the laboratory immediately.

Throat Swab for C&S

1. Insert the **sterile** swab carefully through the mouth with the tongue depressed.
2. Rub swab over each tonsillar area and the posterior pharynx. Any area with exudates should be sampled.
3. Do not allow swab to touch the tongue or lips.
4. Insert swab in its carrier tube or transport media and send to the laboratory immediately.

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If **diphtheria** is suspected:

1. Lift edge of the membrane and swab under it.
2. Obtain at least 2 swabs and send to the lab immediately.
3. Please state the pathogen interested (*Corynebacterium diphtheriae*) specifically on the request form and inform the Bacteriology Laboratory at the ext. 5152.

Nasopharyngeal Swab for C&S

Note: The nasopharyngeal swab for **whooping cough** is obtainable from Microbiology lab.

1. This is especially useful for the diagnosis of whooping cough.
2. A special swab mounted on a soft flexible wire is used.
3. Pass the swab gently through the nostril and along the floor of the nasal cavity into the posterior nasopharynx, rotate it and withdraw.
4. Culture directly onto charcoal agar at bedside and dispatch the specimen to the laboratory immediately.
5. Please state the pathogen interested (*Bordetella pertussis*) specifically on the request form and inform the Bacteriology Laboratory at the ext. 5152.

Tracheal aspirate, Bronchoalveolar lavage (BAL), Bronchial washings

1. Place the aspirate or bronchial washing in **sterile** container.
2. Send to lab immediately.
3. If delay is unavoidable, store in refrigerator for not more than 24 hours.

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Urine

1. Collect 25 ml of midstream urine in a **sterile** container. Early morning urine is preferable. If not possible a period of 3 hours must elapse after the last urination.
2. Male patients should cleanse the glans penis with plain soap and water after retracting the foreskin.
3. Female patients should similarly cleanse the labial folds and vulva.
4. Discard the first portion of voided urine and collect the midstream urine directly into a **sterile** container.

Note: The specimen should reach the laboratory within 1 hour after collection. In case of delay, store at 4⁰C for not more than 24 hours.

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Mycological Examination (microscopy) for hair, skin, nail

1. Specimen for the diagnosis of hair dermatophytosis should include affected hair with bases of shafts intact.
2. For skin dermatophytosis or primary cutaneous candidiasis obtain skin specimens by scraping the active borders of the lesion with a blunt sterile scalpel after wiping the affected area with alcohol swab.
3. Obtain nail specimens by clipping the affected area of nail and include scrapings of the excess keratin produced beneath the nail.
4. Place all hair, skin and nail specimens in a clean envelope or sterile container for transport to the laboratory. If storage required, store at room temperature.

Tissue

1. Collect tissue and transfer aseptically into a **sterile** container.
2. Do not add any fluid or formalin.
3. Send immediately to the lab.

Pus Aspirate

1. Clean the skin over the inflamed area by wiping with sterile saline or 70% alcohol.
2. With a sterile syringe, aspirate the pus or exudate and transfer the pus into a **sterile** container.
3. Send the specimen immediately to the laboratory.

Note: Tissue or aspirate is always superior to swab specimen. If swab must be used, pass swab deep into lesion and preserve it in Stuart's or Amies Transport medium.

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Pus for Gonococci

1. For optimum recovery, exudate from relevant sites should be immediately streaked onto GC LCAT Agar plates (allow to reach room temperature before use).
2. Please state the pathogen interested (*Neisseria gonorrhoea*) specifically on the request form.
3. Send to the laboratory immediately.

Note: The above specimen is to be accompanied by a smear for Gram stain.

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Genital specimens

Endocervical swab

1. Visualize cervix using speculum without lubricant.
2. Remove mucus and secretions from cervix with swab and discard swab.
3. Sample endocervical canal with sterile swab.

Note: Endocervical swabs should be taken for culture of gonococci. HVS is not suitable.

High vaginal swab (HVS)

1. Wipe away excess amount of secretion/discharge.
2. Obtain secretion from mucosal membrane of vaginal vault with sterile swab and send swab to the lab in transport media.

Note: For intrauterine device, place the entire device into sterile container and send to lab at room temperature.

Urethral swab

1. Insert swab 3 – 4 cm into the anterior urethra.
2. Leave the swab in place for few seconds to allow saturation with exudates.

Clostridium difficile in stool

1. Collect fresh stool (approx. 1 tablespoonful) in a sterile bottle.
2. Send to the lab immediately.

Note: Please include the relevant clinical summary for this test as follows:

- a. Antibiotic-associated diarrhoea
- b. Colitis
- c. Pseudomembranous colitis

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Urease test for *Helicobacter pylori* organism

1. Place a tiny piece of tissue into the urease medium.
2. Send to the lab as soon as possible together with an uninoculated tube of the urease medium as control.

Intravenous Catheter tip

1. Clean the skin around the catheter site with alcohol.
2. Aseptically remove and clip 5cm distal tip of catheter into sterile container and send immediately to lab. **DO NOT send the whole catheter** for culture as it is too big for the culture media.
3. Store in refrigerator for not more than 24 hours if delay is unavoidable.

Note: Intravenous catheter tips **SHOULD ONLY** be sent if catheter or continuous bladder drainage (CBD) catheter related bloodstream infection is suspected. Foley's catheter is not acceptable for culture since growth represent distal urethral flora.

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Blood Film Filaria Parasite (BFFP)

1. Before collecting the blood, disinfect the venipuncture site.
2. Collect 5 ml of blood in an EDTA tube at night (between 10 pm – 2 am) and send to the laboratory.
3. Prepare a thick smear on slides.
4. Leave to dry and send them together with the blood tube to the laboratory.

Blood Film Malaria Parasite (BFMP)

1. Before collecting the blood, disinfect the venipuncture site.
2. Collect 5 ml of blood in an EDTA tube and send to the laboratory.
3. Prepare a thick and thin smear on slides.
4. Leave to dry and send them together with the blood tube to the laboratory.

In-use test for disinfectants

1. Aseptically transfer 5 ml of disinfectant into a sterile bottle.
2. Send to the lab immediately.

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Autoclave Sterility Test

1. Send Biological indicator vials that have gone through the autoclaving cycle together with an unautoclaved biological indicator (Control) to the lab.
2. Ensure that both test and control Biological are from the same batch.

Environmental sampling

1. Aseptically transfer 5ml of specimen into a sterile bottle.
2. For settle plate, the media plates are available from the laboratory upon request.

Note: All the environment specimens ONLY can be received from Infection Control Nurse under special circumstances (e.g. outbreak) and should inform the laboratory before sending the specimens.

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Sputum for MTB

1. Sputum is preferably collected when the patient first wakes up in the morning. Gargle mouth with water before sputum collection.
2. Ask the patient to take a deep breath and spit directly into a screw-capped **sterile** container. Ensure that the expectorated is sputum and not saliva.
3. Send the specimen immediately to the laboratory. If delay is unavoidable, store it in a refrigerator.
4. Send the sputum AFB direct smear (D/S) and sputum AFB C&S to TB Lab during office hours.
5. MTB/RIF Molecular Test (Xpert MTB/RIF) must be requested only by Chest physician (for adults) or Paediatric Infectious Disease Specialist (for paediatric patients). Collect sputum in sterile container and send to TB Lab during office hours.

Other specimens for MTB:

1. Collect specimens aseptically.
2. Transfer the specimen into **sterile** universal container and send to the lab without delay. If delay is unavoidable, store it in a refrigerator.

Blood / Bone marrow aspirate for MTB

1. For the isolation of *Mycobacterium* from blood; especially in HIV patient, BACTEC MYCO F/LYTIC bottle should be used. The BACTEC MYCO F/LYTIC bottle can be obtained from TB Lab (Ext. 5216).
2. For the instruction of blood collection for BACTEC MYCO F/LYTIC bottle, please refer Blood C&S (Blood Culture Bottles).
3. Send the specimen to TB lab within 24 hours after collection.

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SEROLOGY

GENERAL

1. Specimens collected should be of adequate volume and be placed in appropriate containers.
2. Blood collected in plain tube should be allowed to clot by standing undisturbed at room temperature.
3. Clotted blood may then be stored at 4⁰C if delay is unavoidable.
4. Each specimen should be accompanied by **fully completed** PER-PAT 301 request form including clinical summary and diagnosis.
5. Laboratory Turnaround time (LTAT) – please refer to the Microbiology Laboratory Customer Charter.

SPECIFIC REJECTION CRITERIA

Generally, any specimen which does not fulfil the criteria for specimen collection, dispatch & transportation will be subjected to rejection / hold on for verification.

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COLLECTION OF SPECIMENS

For normal serological and immunological test

1. Collect 3.5 ml of venous blood into a plain tube.
2. Send the specimen to the serology laboratory immediately.

Note: For district hospitals, to avoid hemolysis, the serum must be separated in a sterile screw-capped container. The specimen must be sent to the serology lab as soon as possible. If there is any delay the serum must be kept at 4 °C.

Serum for Dengue Rapid NS1Ag, IgM and IgG

- Collect blood by venipuncture into a sterile plain tube and allow it to clot.

Leptospirosis

1. Specimen:
 - a. Blood:
 - i. Collect blood in plain tube for serology or in EDTA tube for PCR.
 - ii. Each tube should contain at least 3ml of whole blood.
 - b. CSF / sterile body fluid / bronchial lavage / tissue / postmortem specimen:
 - i. Collect in sterile container for PCR.
2. Completed laboratory request form and specimen should be sent to IMR.
3. For PCR request, it is for ICU cases and after consultation only.
4. Transportation at ambient temperature. If delayed, keep at 2-8°C.

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HIV Ag/Ab combo, HBsAg, anti-HCV antibody Test, Anti-HBs antibody, anti-Cytomegalovirus (CMV) IgG and IgM, anti-Rubella IgG and IgM, Toxoplasma gondii Ig G and IgM tests, Anti-HB core (total antibody), EBV IgM and IgG, HSV IgM and IgG, Dengue IgM

1. Collect 3.5 ml of blood into a sterile plain tube.
2. Send the specimen to the laboratory immediately.

Note: **All test requests must be accompanied by a completely filled** PER-PAT 301 request form with patient's particulars, relevant clinical history, doctor's full name and signature.

Anti-HBcore antibody, HBe antigen, anti-HBe antibody tests

1. All tests must be requested only by Specialist, **accompanied by a completely filled** PER-PAT 301 request form with patient's particulars, relevant clinical history, doctor's full name and signature.
2. Collect 3.5 ml of blood into a sterile plain tube.
3. Send the specimen to the laboratory immediately.

ANA/dsDNA/ENA panel

1. Collect 3.5 ml of blood into a sterile plain tube.
2. All the test must be requested only by **Specialist**.
3. The dsDNA test and ENA panel will be done only if the ANA is positive and upon special request by Rheumatologist.

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Rapid Plasma Reagin Test (RPR), Rheumatoid Factor (RF), Anti-Streptolysin O Test (ASOT)

- RPR, RF and ASOT samples are collected in 3.5 ml of blood into a sterile plain tube.

Treponema Pallidum Particle Agglutination (TPPA) and Mycoplasma

Serology

- Collect 3.5 ml of blood into a sterile plain tube.

Organ donation

1. Please inform the serology lab or the Medical Microbiologist on duty after the organ donation procurement is alerted.
2. Sample is to be sent directly to the Serology Lab.

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MOLECULAR DIAGNOSTIC

GENERAL

1. All tests for HIV viral load must be requested only by **ID Specialist/Consultant** or **Family Medicine Specialist**.
2. All HBV and HCV PCR/viral load must be requested only by **Specialist**.
3. Laboratory Turnaround time (LTAT) – please refer to the Microbiology Laboratory Customer Charter.
4. Additional rejection criteria specific for viral load and influenza PCR is implemented.

SPECIFIC / ADDITIONAL REJECTION CRITERIA

Generally, any specimen which does not fulfil the criteria for specimen collection, dispatch & transportation will be subjected to rejection / hold on for verification.

HIV, HBV, HCV Viral Load

1. Plasma/Serum not removed from the red blood cells within 4 hours from collection time with the time of collection and time of separation stated.
2. Improper specimen storage and transport.
3. Specimen received after 5 days of separation of sample collection.
4. Haemolysed or lipaemic samples.

INFLUENZA A & B PCR

1. Specimen received more than 24 hours after collection.
2. Improper specimen transport / storage.
3. Specimen collected with calcium alginate/cotton swab or not in VTM.
4. Inappropriate specimen types (e.g. urine, blood, body fluids).

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COLLECTION OF SPECIMENS

Viral Load

1. Collect 3.5 ml of blood in each 4 EDTA tubes.

Important: DO NOT USE the Lithium Heparin tube as it will inhibit the PCR process.

2. Pack with ice and send in flask/suitable container.
3. Send as soon as possible within 4 hours collection.

Note: For other hospital/clinic:

1. Spin for plasma by centrifuge at 3000 rpm for 15 minutes and send only the plasma.
2. Plasma may be transported and refrigerated at 2-8 °C for up to 5 days. If longer storage is required, plasma specimens must be kept at -70°C or lower.

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Influenza A & B PCR

- i. Type of sample:
 - i. Nasopharyngeal aspirate/swab
 - ii. Oropharyngeal swab/ Throat swab
 - iii. Sputum
 - iv. Tracheal aspirate
 - v. Bronchioalveolar lavage (BAL)
- ii. Please call ext. 5220 to ask for the specimen collection kit.
- iii. Collect swab sample in VTM or collect nasopharyngeal aspirate / sputum / tracheal aspirate / BAL in sterile container.
- iv. Send the specimen in **triple layer packaging with ice** to **Entrance 009A** of the Pathology Department.
- v. Request form must be attached outside of the box.
- vi. Please refer to the flowchart on page 56.

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Middle East Respiratory Syndrome Coronavirus (MERS CoV) PCR and Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2) PCR

1. Type of sample:
 - a. Nasopharyngeal aspirate/swab
 - b. Oropharyngeal swab/ Throat swab
 - c. Sputum
 - d. Tracheal aspirate
 - e. Bronchioalveolar lavage (BAL)
2. Please call ext. 5220 (during office hours) or 5152 (after office hours) to ask for the specimen collection kit.

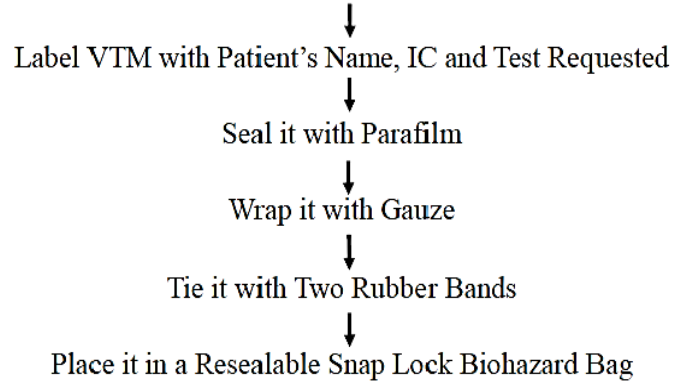
*****Please note that the flowchart is subjected to change according to the outbreak situation. Please check with the Molecular Lab for the latest work flow.***

3. Collect swab sample in VTM or collect nasopharyngeal aspirate / sputum / tracheal aspirate / BAL in sterile container.
4. Send the specimen in **triple layer packaging with ice** to **Entrance 009A** of the Pathology Department.
5. Request form must be attached outside of the box.

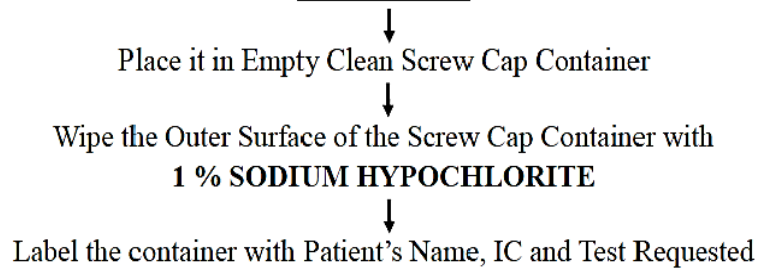
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Basic Triple Packaging System

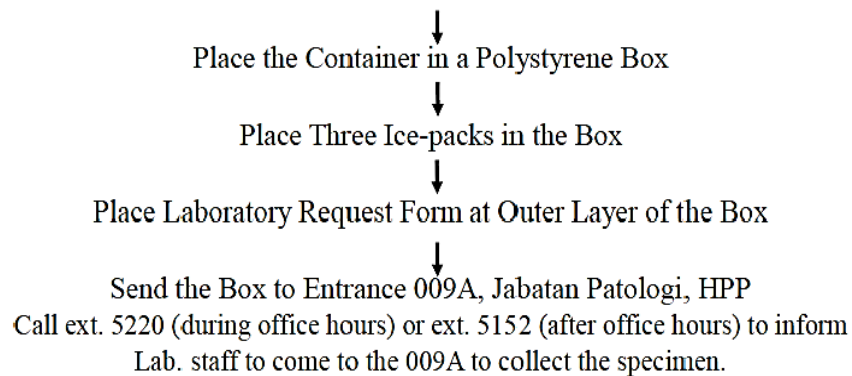
First Layer



Second Layer



Third Layer



Please strictly follow Triple Packaging steps as stated above before sending the specimen to avoid rejection.

****Please note that the flowchart above may be subject to change according to the outbreak situation. Please check with the Molecular Lab for the latest work flow.**

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CUSTOMER CHARTER MICROBIOLOGY LABORATORY DEPARTMENT OF PATHOLOGY

TESTS	LTAT
C&S Report (No Growth)	
<ul style="list-style-type: none"> • Urine 	2 days
<ul style="list-style-type: none"> • CSF, Body Fluid, Tracheal Asp, Sputum, Pus, Tips, Swab, Tissue, Bone, Stool, Genital 	3 days
<ul style="list-style-type: none"> • Blood final report 	5 days
C&S Report (Growth)	
<ul style="list-style-type: none"> • CSF, Body Fluid, Tracheal Asp, Sputum, Pus, Tips, Tissue, Swab, Bone, Genital Swab, Urine 	5 days
<ul style="list-style-type: none"> • Stool 	7 days
<ul style="list-style-type: none"> • Blood final report <ul style="list-style-type: none"> ○ Aerobic culture ○ Anaerobic culture 	7 days 9 days
<ul style="list-style-type: none"> • CSF Gram Stain & Indian Ink for CSF (preliminary result) • CSF Cryptococcal Antigen Detection Test • Stool for Ova and Cyst 	1 hour
Clostridium difficile Toxin	2 hours
Blood Film Malaria Parasite	4 hours
AFB Direct Smear	1 working day
TB: Culture, TB: Identification & Drug Sensitivity (MKAK)	10 weeks

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Fungal Culture	3 weeks
HBsAg, Anti HBs, Anti HBe, HBeAg, Anti HBcore (total antibody), Anti-HCV, HIV Ag/Ab combo, Toxoplasma IgM, CMV IgM, Rapid Plasma Reagin (RPR), Anti Streptolysin O titre (ASOT)	1 working day
Toxoplasma IgG, CMV IgG	2 working days
Dengue IgM & IgG, EBV IgM, HSV IgM, TPPA, Mycoplasma pneumoniae serology, Antinuclear Antibody, Anti dsDNA, ENA	7 working days
EBV IgG, HSV IgG, HIV-1 / HBV / HCV Viral Load	14 working days
Chlamydia trachomatis PCR, Influenza A & B PCR	3 working days
Cryptococcal Antigen Serum-upon request	1 working day
MERS-CoV / SARS-CoV-2 PCR	2 days
Respiratory Viruses Antigen Detection Test	1 working day
Covid-19 RTK, Dengue Combo Rapid Test, Leptospira Rapid Test	1 hour

CHAPTER III:

CHEMICAL PATHOLOGY

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CHEMICAL PATHOLOGY

INTRODUCTION

Chemical Pathology Laboratory is part of the Pathology Department. The unit provides diagnostic and consultation services that cover analysis and interpretation of biochemical changes in blood and body fluids for diagnosis, monitoring and screening of diseases.

SERVICES PROVIDED

1. General Biochemistry
2. Therapeutic Drug Monitoring and Immunosuppressant
3. Endocrine and Metabolic
4. Extended Endocrine and Metabolic
5. Serum protein electrophoresis and Free Light Chain

REJECTION CRITERIA

- i. Wrong container
- ii. Insufficient sample
- iii. Haemolysis or Lipemic sample
- iv. Incorrect patient preparation
- v. Incomplete request form
 - Incomplete patient information
 - No test indication
 - No clinical history
 - No requesting doctor's name and signature

★ IF THE ABOVE CRITERIA ARE NOT MET, SAMPLE WILL BE REJECTED

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DEFINITION

1. General Biochemistry

- The laboratory offers 24 hours services daily including weekend and public holidays for general biochemistry tests (Refer to Appendix 1).

2. Therapeutic Drug Monitoring and Immunosuppressant

- The laboratory offers 24 hours services for acetaminophen and salicylate.
- Others Therapeutic drug monitoring and Immunosuppressant (Cyclosporin and tacrolimus) are offered weekdays (Monday to Friday) and Saturday only (Refer to Appendix 1).

3. Endocrine and Metabolic

- Endocrine and Metabolic tests such as hormones and tumour markers are run as per respective schedules (Refer to Appendix 1)

4. Extended Endocrine and Metabolic

- Thyroid autoantibodies (Anti-TPO, Anti-Thyroglobulin (Anti-TG)), Thyroglobulin and Parathyroid Hormone (PTH), anaemia studies (Vitamin B12, Folate) are offered on weekdays (Monday to Friday).
- Vitamin D and Procalcitonin are offered 24 hours (Refer to Appendix 1).

5. Serum protein electrophoresis and Free Light Chain

- Serum protein electrophoresis and Free Light Chain are offered on weekdays (Monday to Friday) (Refer to Appendix 1).

6. Urgent tests (Short LTAT)

- Tests (single test, profile tests) urgently required for immediate patient management as indicated by clinician on the request form.
- These tests are offered 24 hours, 7 days/week.

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Critical Values

Department of Pathology

Hospital Pulau Pinang

Analytes	Critical value
Fasting Glucose dan Random Blood Glucose	≤ 2.8 or ≥ 20.0 mmol/L
Potassium	≤ 2.8 or ≥ 6.0 mmol/L
Sodium	≤ 125 or ≥ 155 mmol/L
Bilirubin neonate	≥ 300.0 mmol/L
Calcium	≤ 1.5 or ≥ 3.0 mmol/L
Ammonia	≥ 100.0 umol/L
Acetaminophen	> 5.0 ug/L
Salicylate	> 5.0 ug/mL



LIST OF TESTS

- Please refer to [Appendix I](#).

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TYPES OF SAMPLE CONTAINER

Blood Tubes

Tubes	Colour Code	Additives	Laboratory Use
	Green	Lithium heparin	General biochemistry tests, Endocrine and Metabolic tests
	Grey	Potassium oxalate, Sodium fluoride	Glucose, Lactate (in ice),
	Lavender	Spray-coated K ₂ EDTA	HbA1C, Ammonia (in ice), iPTH (in ice)
	Red	Clot activator, Silicone Coated	Protein Electrophoresis, serum free Light chains, Thyroglobulin, Thyroglobulin Antibody, Thyroid Peroxidase Antibody
	-	Heparinized syringe	Arterial blood gases, Venous blood gases, pH for body fluid
	Whatman Paper	-	Dried blood spot for IEM screening

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Urine/ Body Fluids Container

Appearance	Container	Laboratory Use
	Sterile universal plastic container for random urine, body fluids or CSF.	Body fluids, CSF or Random urine test (Please refer test list Appendix I)
	Plastic container for 24 hours urine collection	24 hours urine tests (Please refer test list Appendix I)

Preservatives for 24hours urine collection:

No	Tests	Preservatives
1	5 Hydroxyindol Acetic Acid (5-HIAA)	6M HCL-10 ml
2	Catecholamines/Metanephrines	32% HCL-10 ml
3	Calcium, Chloride, Copper, Cortisol, Creatinine, Glucose, Magnesium, Phosphate Inorganic, Potassium, Protein Creatinine Index, Protein, Sodium, Urea,	Nil
4	Uric Acid	Boric Acid- 10 g

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SPECIAL PROCEDURES

Arterial/venous Blood Gases (ABG/VBG) collection procedure.

1. Use 1- or 2-ml disposable syringe and flush heparin through needle.
2. If preheparinised syringe is used, omit the flushing heparin step.
3. Draw 1 ml of blood
4. Remove the needle and discard immediately into sharp bin.
5. Expel the air bubbles in the syringe.
6. Place a stopper to avoid blood sample leakage.
7. Invert the syringe to prevent clotting.
8. Insert the syringe into blood gas analyser (Point of care testing sites).
9. Put the filled syringe into ice slurry to transport to laboratory if needed
(For non-Point of care testing sites).

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Lactate collection procedure

1. A venous specimen is best drawn without a tourniquet or immediately after the tourniquet has been applied briefly.
2. If the tourniquet has been applied for a long period, it should be removed after the puncture has been performed and the blood is allowed to circulate for at least 2 minutes before being withdrawn.
3. 5 ml of blood (1.5 mL for paediatrics) is collected in a container with fluoride as antiglycolytic (Potassium oxalate/sodium fluoride).

Important notes

- Sample should be transported in ice slurry immediately to the laboratory after collection.
- CSF lactate can be collected in universal bottle/Bijou bottle as it is obtained and transported immediately to the laboratory after collection.

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Ammonia collection procedure

1. A venous specimen is best drawn without a tourniquet or immediately after the tourniquet has been applied briefly.
2. If the tourniquet has been applied for a very long period, it should be removed after the puncture has been performed and the blood is allowed to circulate for at least 2 minutes before being withdrawn.
3. 5ml of blood (1.5 mL for paediatrics) is collected in a container with K₂EDTA as anticoagulant.
4. Sample should be transported immediately in ice to the laboratory after collection.

Important notes

- The collection tube (microtainer) should be completely filled with blood and kept embedded in ice slurry and send transported immediately to the laboratory.

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24 hours Urine Collection

General biochemistry tests are performed on urine specimen collected over 24 hours. The 24 hours timing allows for the circadian rhythmic changes in excretion of analytes throughout the day.

Collection procedure

1. The 24-hour urine bottle, which contains preservative for the required test, is available at the pre-analytical counter and will be provided on request, with the accompanying request form or note.
2. On the day of collection, the first urine voided must be thrown away. Time of first urine voided is the start of the timing for the 24-hour collection.
3. Collect the second and all subsequent voided urine for 24 hrs from the time start into the 24-hour urine bottle.
4. Do not urinate directly into the 24-hour urine bottle to avoid skin injury from the splashed acidic preservative.
5. At the end of 24 hrs, the last urine voided is collected. For best result, refrigerate if possible.
6. Label the bottle as directed (if collected at ward or clinic) and send immediately to the laboratory.

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Creatinine Clearance Test

1. A 24-hour urine collection is required.
2. A careful and accurate 24 hours collection of urine is made.
3. At the same time during the day (but not within 1-hour after a large meal) a blood sample is taken for serum creatinine analysis.
4. Blood and the whole 24 hours urinary collection are sent to the laboratory.
5. Reference value: (Endogenous Creatinine Clearance)
6. Normal adult: 52 - 158 ml/min.

Serum Protein Electrophoresis and Serum Free Light Chains

1. Use for screening symptomatic patients with suspected monoclonal gammopathies and for assisting in the diagnosis of monoclonal gammopathies, when used in conjunction with serum free-light chains.
2. The test should be requested by Haematologist/Physician only.
3. Send in 2 plain tubes (blood volume requirement of 5 ml)
4. Causes of Rejection:
 - Not collected in plain container.
 - Insufficient sample.
 - Haemolytic sample.
 - Incomplete request form: -
 - i. Incomplete patient information
 - ii. No test indication
 - iii. No clinical history
 - iv. No requesting doctor's name and signature

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Urinalysis

1. Examination of urine using chemical reaction (chemical urinalysis) and microscopy method to detect presence of proteins, haemoglobin, red blood cells, leucocytes, abnormal red blood cells, pathological casts and crystals.
2. Urine collected (in a universal container with minimum 30 ml of urine) needs to be sent to the lab immediately to enable the urine sample to be processed within 2 hours of urine collection to avoid pre-analytical interferences.
3. Urine microscopy will be reflexed based on the presence of proteinuria blood and leucocytes.

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Serum Cryoglobulin

Indication:

- To demonstrate the presence of cryoglobulins in serum of patients with diseases associated with “autoimmune” features such as lymphoproliferative disorders, connected tissue diseases and viral infection.

Requirement:

- Tests are done by appointment. Clinicians need to send their patient to the Chemical Pathology Special lab for blood taking.

Serum Cryoglobulin Test	Blood taken in Chemical Pathology Special Lab	Per-PAT 301	By appointment (Tuesday Only) Call ext. 5651	5 working days
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Metabolic diseases/Inborn error of metabolism (IEM)

Blood gasses, glucose, ammonia, LFT and plasma lactate are important basic tests which can provide diagnostic clues to the type of metabolic disorder a patient is having and should be done to any patient suspected of having IEM before further samples are sent to referral centres e.g. IMR, KL for confirmation. Metabolic screening will be done on 3 mm dried blood spot using tandem mass spectrometry (refer to special procedure). Clinicians are advised to send dried blood spot (using Whatman filter paper), blood and random urine samples together for IEM screening in order for the referral lab to proceed to confirmatory tests once metabolic screening is positive.

Procedure for IEM

1. Use special form (IEM form) (refer to [HPP OUTSOURCE TEST LIST](#)) when requesting test.
2. Fill up important clinical signs and results of the routine chemistry tests done at the laboratory.
3. For the diagnosis of most amino acid disorders, morning fasting blood specimens are preferred to avoid post-prandial increase of most of the amino acid.
4. Samples from young infants, who are fed at frequent intervals, should be collected immediately before the next scheduled feeding.
5. For hyperammonemia screening post-prandial blood is more suitable since an elevation of blood ammonia may be intermittent and present only in the fed state.

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24hrs Urine Metanephrines (Referral laboratory)

Instruction on patient preparation and specimen collection.

1. Abstain from coffee, spicy food and curry leaves one week prior to testing.
2. List of drugs that may alter the metabolism of Catecholamines:
 - i. Alpha -2- agonists
 - ii. Methyldopa
 - iii. Monoamine oxidase inhibitors
 - iv. Alpha blockers and Beta blockers
 - v. Phenothiazines
 - vi. Tricyclic antidepressants
3. It is advisable to stop such medication at least one week prior to urine sampling.
4. Collect 24hrs urine specimen in a clean container to which 10 ml of 32% HCL has been added as a stabilizing preservative.
5. Please advise patients not to throw away the preservative.
6. Refrigerate during and after collection (if possible).
7. Indication for urine Metanephrines: -
 - i. Patient with Triad of episodic headaches, tachycardia and diaphoresis (with or without associated hypertension).
 - ii. Family history of Pheochromocytoma.
 - iii. "Incidental" suprarenal masses.
 - iv. Patient with multiple endocrine neoplasia 2 (MEN2), neurofibromatosis or Von Hippel-Lindau disease.
 - v. Adverse cardiovascular responses to anaesthesia, to any surgical procedure, or to certain drug (e.g. guanethidine, tricyclics, thyrotropin-releasing hormone, naloxone or antidopaminergic agents).

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Criteria for 24-hour Metanephrines analysis by Referral laboratory.

- a. pH urine < 2, urine 24hr volume > 1000 mL.
- b. 10 mL of 32% HCL entered into the urine container as preservative.
- c. Minimum one litre of 24-hour urine volume should be collected by the patient (adult).
- d. Minimum specimen urine volume that should be sent to HKL to be processed is > 10 mL.
- e. The test request is to be screened and approved by endocrinologist and chemical pathologist so that indicated requests are only performed due to the high cost of the test.

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24hrs Urine 5 HIAA (5-Hydroxyindoleacetic acid) - (Referral laboratory)

1. Patients should avoid banana, pineapple, all tomato products, plums, eggplant, kiwi, avocado and fruits in general, nuts especially walnuts.
2. These foods should be avoided at least 24 hours prior to and during collection of urine. Do not drink any alcohol for 24 hours before test.
3. Lists of drugs may affect test results and must be avoided: -
 - a. Cough and antihistamine
 - b. Nasal drops and sprays
 - c. Hypertension medications
 - d. Tylenol and muscle relaxants (Robaxin, Valium, Flexeril)
 - e. Nardil and natural herbs containing monoamine oxidase.
 - f. Acetaminophen
4. It is advisable to stop such medication at least 2 days prior to urine sample.

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Plasma Renin Activity (PRA) and Serum/ Plasma Aldosterone Tests (Referral laboratory)

Indication

- Screening for Primary hyperaldosteronism in hypertensive patients with spontaneous or diuretic-induced hypokalemia.

Suggested candidates for screening:

- a. Patients with hypertension and hypokalemia.
- b. Patients with resistant hypertension.
- c. Young hypertensive (age < 40).
- d. Patients with adrenal tumour.

Principles

1. The renin-aldosterone axis primarily regulated by renal blood flow.
2. Subjects under investigation should, therefore, not be taking any drugs that interfere with fluid balance or potassium.

Patients Preparation

1. Drugs to avoid: *spironolactone, ACE inhibitors, ARB, betablockers, Cyclic progestogens, estrogens and licorice.
2. Drugs that do not interfere with the renin-aldosterone axis include Prazosin, verapamil and terazosin.
3. Subject should be normally hydrated and has an adequate oral intake in sodium.
4. Avoid hypokalemia as it suppresses aldosterone secretion. Give potassium replacement (Slow K tabs) sufficient to raise plasma potassium > 4.0 mmol/L. Replacement should be stopped on the day of the test.

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5. *Spironolactone must be stopped for 6 weeks to be certain that any elevation in plasma renin activity is not due its inhibition of aldosterone.
6. Ideally all interfering drugs should be stopped at least 2 weeks prior to sampling.

Requirements

Drug	Physiological effect	Time to remove interference
ACE inhibitors	Increase PRA & reduce aldosterone	2 weeks
Beta-blockers	Reduce PRA more than aldosterone	2 weeks
Calcium channel blockers	Reduce aldosterone and stimulate renin production	2 weeks
Diuretics	Increase PRA and aldosterone	2 weeks
Hypokalaemia	Inhibits aldosterone secretion	2 weeks
NSAIDs	Retain sodium & reduce PRA, effect on aldosterone	2 weeks
Oestradiol	Increase renin Substrate	6 weeks
Spironolactone	Increase PRA, variable effect on aldosterone	6 weeks

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- Potassium EDTA (K₂EDTA) tube for renin.
- Potassium EDTA (K₂EDTA) tube for aldosterone.
- Blood sample should be sent rapidly to the laboratory but not in ice (within 30 minutes) as cooling would cause cryoactivation, leading to falsely raised renin.

Procedure

1. The patient should remain seated for 10 minutes prior to venipuncture.
2. Collect samples into 2 tubes of EDTA. (Please use different tubes for Renin and Aldosterone. Suggest to collect minimum 3mL blood per sample, as at least 500µL plasma need for each analysis).
3. Fill-up the **PER. PAT 301** form. Only single form is required for requesting Aldosterone Renin Ratio (ARR).
4. Patient's **clinical history** and **drug history** are **MANDATORY**.
5. Test should be requested by **Specialist/ Endocrine Specialist** only.
6. Please record patient's posture whether supine or upright.
 - a. Supine sample:
 - Sample taken in the early morning before the subject arises (If feasible).
 - b. Upright sample:
 - Subject should be upright for ≥ 2 hours prior to sampling
7. Samples should be taken between 8am to 10am.

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Interpretation

1. High aldosterone and suppressed plasma renin indicates primary hyperaldosteronism.
2. Some patients with renal disease may give similar results.

Instruction for Lab Personnel

1. Upon arrival
 - a. Separate plasma (Renin or aldosterone) immediately.
 - b. Transfer the plasma into a plastic/ secondary tube.
 - c. Minimum volume for Plasma Renin and Plasma Aldosterone is 500µL of PLASMA for each analyte.
 - d. Samples should be frozen as soon as possible (-20°C or lower).
 - e. Samples tubes should each have the following information: (Barcode or manual labeled)
 - i. Requested test.
 - ii. Patient's name
 - iii. Identity card number/ Medical Registration Number (MRN)
 - iv. Date of collection
2. Transportation of Sample
 - a. Samples should be sent frozen, packed in ice and place in sturdy insulated container.
 - b. Samples not received in optimum condition shall be rejected.
3. Sample Stability
 - a. 60 days at -20°C.

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CUSTOMER CHARTER
CHEMICAL PATHOLOGY
DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG

No.	TEST	LTAT
1	Routine test results	3 hours
2	URGENT test results (except for many/group profiles request)	60 Minutes
3	Endocrine and metabolic tests results	1 working day
4	HbA1C test results	3 working days
5	Serum Protein Electrophoresis dan Serum Free Light Chains results	10 working days



CHAPTER IV: **HISTOPATHOLOGY**

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HISTOPATHOLOGY

INTRODUCTION

Histopathology unit and staffs are dedicated to serve the region and community by providing superior diagnostic care, supporting and conducting advanced research, and educating professionals in histopathology and its subspecialties.

The Histopathology Unit is concerned with diagnosis by macroscopic and microscopic examination of tissues removed during surgery and non-surgical biopsy procedures. The quality of the histopathological examination (HPE) depends heavily on the information provided on the request form such as clinical history, physical examination, working clinical diagnosis, imaging findings, intraoperative findings, previous histopathological diagnosis, previous chemotherapy or radiotherapy etc.

SERVICES PROVIDED

- ✓ Formalin-fixed specimens for:
 - Routine Haematoxylin and Eosin (H&E) stain.
 - Histochemical stains.
 - Immunohistochemistry (IHC) stains.

- ✓ Fresh specimens for frozen sections and Immunofluorescence (IF) stains.

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REQUEST FOR HISTOPATHOLOGY SERVICE

1. General (routine) histopathology.

Use a double copy of PER-PAT 301 request form, completely filled in with relevant clinical information for all histopathological examination requests.

A request with multiple specimens only requires a double copy request form. If the report is needed urgently, please mark the request form **URGENT** in red clearly at the top right-hand corner.

2. Frozen section.

All requests for frozen section examination must be preceded by an appointment and discussion with the Surgical Pathologist on-call **AT LEAST 24 HOURS IN ADVANCE** before the operation. This is followed by filling up the request form for the frozen section (HPP/PATr/HP/SD/178-Pind.03/2022) and submitting it to the Histopathology Laboratory for notification.

Request form for frozen section (HPP/PATr/HP/SD/178-Pind.03/2022) is available at the Histopathology Laboratory.

Fresh specimen **without** fixative is to be sent immediately to the Histopathology Laboratory together with a request form (PER-PAT 301).

The specimen must be labelled correctly and the surgeon's name, contact phone number or extension number must be written on the request form.

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Result of the frozen section will be verbally communicated to the surgeon in the operating theatre via the phone. Written report will be issued by the Pathologist in charge after completion of the paraffin block.

Please inform the Medical Officer /Pathologist when:

- i. The patient is wheeled into the operating room.
- ii. The frozen section examination is cancelled.

All cases scheduled for frozen section examination are best placed first in the operating list.

3. Specialised histopathology services.

The Unit accepts referrals or cases for second opinion.

For HPP patients that need a second opinion, the requesting doctor is required to fill up the request form as routine cases with a copy of the HPE report and submit it to Histopathology Laboratory together with the specimen (paraffin embedded tissue, stained and/or unstained slides). Paraffin embedded tissue is preferred if the cases need further ancillary studies or staining.

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SPECIMEN COLLECTION AND CONTAINERS

REQUEST FORMS

- Specimens must be accompanied by request forms (PER-PAT 301).
- All request forms must include:
 - i. Patient's particulars and relevant clinical information. The 12-digit Malaysian NRIC number or for foreigners' Passport number must be written in full.
 - ii. Previous HPE diagnosis and report number (if applicable).
 - iii. The requesting doctor's name, department, subspecialty, ward, clinic, contact phone number, type of specimen, date and time of collection should be legibly written.
 - iv. All urgent requests should be indicated clearly on the request forms, please mark the request form **URGENT** in red clearly at the top right corner.
 - v. Please indicate clearly on the request form the department, clinic or ward the HPE report should be dispatched to.

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SPECIMEN COLLECTION

- All specimens for routine histological examination are to be fixed in a 10% Neutral Buffered Formalin (NBF) solution inside a suitable clean leak-proof container.
- The volume of formalin used must be at least 10 times the volume of specimen to be fixed.
- Large specimens are advised not to put in small containers as this would prevent proper fixation of the tissue and distort the specimen.
- All specimen containers should have the same identification details as that written on the request forms.
- Multiple small specimens such as gastrointestinal biopsies should ideally be mounted on a piece of filter paper and immediately put in formalin.
- Specimens from different anatomical sites should be sent in separate containers, properly labelled and must be clearly itemized in the request form.
- For cases that require confirmation of the adequacy of surgical excision, the margins of the specimen must be marked or tagged accordingly by sutures or by diagrammatic representation of the excised specimen.
- Specimens for frozen sections must be sent fresh without fixative immediately to the Histopathology Laboratory.

- ❖ Specimens for immunofluorescence stains must be sent fresh in Phosphate Buffered Saline (PBS), without fixative, immediately to the Histopathology Laboratory.

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DISPATCH AND TRANSPORTATION OF SPECIMEN

Specimens for routine histopathological examination should be sent directly to the Histopathology Laboratory and not at the common specimen reception counter during working hours, or in the morning of the next working day.

Fresh tissue specimen for immunofluorescence stains should be sent immediately to Histopathology Laboratory.

Fresh tissue for frozen section, the specimen should be sent immediately upon removal to the laboratory by a doctor who will wait for the report.

- ★ Note: Any specimen which does not fulfil the criteria for specimen collection, dispatch & transportation will be subjected to rejection / hold on for verification.

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HISTOPATHOLOGY REPORTS

Reports for histopathological examination will be available after receipt of the specimens by the laboratory within: -

- i. 3 working days for urgent biopsies specimens which do not require any further investigation such as immunohistochemistry test, histochemistry test, deeper level, regrossing or second opinion.

Note: Cases requiring further investigations will take extra days.

- ii. 14 Days for routine specimens.
- iii. 45 minutes for every frozen section specimen.

Reports can be viewed by authorized medical staff in the web based [sistem eResults Jabatan Patologi](#) through the Hospital Pulau Pinang intranet system.

There are three types of Histopathology Examination (HPE) report:

- i. **Primary report:** laboratory report from the analysis conducted on specimen and validated by Pathologist.
- ii. **Amendment report:** report which has been revised, corrected or remediated after the original report has been issued. The amended report will supersede the primary report.
- iii. **Supplementary report:** report is utilized/supplement the primary report with additional information pertaining to the initial interpretation.

Verbally informing HPE diagnosis over the telephone by technical staff is prohibited. The doctor in-charge of the patient should contact the Pathologist directly.

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Results of the frozen section will be immediately communicated to the surgeon via telephone or the doctor who brought the specimen to the laboratory.

The critical result will be immediately communicated to the doctor or staff in the ward or clinic via telephone.

The types of critical results to be informed are:

- i) Unexpected or discrepant findings: unexpected malignancy or wrong organ removed.
- ii) Reports of infection: bacteria in heart valves or bone marrow, organisms in an immune-compromised patient (bacilli, fungi, viral), organisms in cerebrospinal fluid, unusual organisms or organisms in unusual sites (amoeba in the eye).
- iii) Reports on critically ill patients requiring immediate therapy: crescents in greater than 50% of glomeruli in renal biopsy specimen and transplant rejection.
- iv) Cases that have immediate clinical consequences: fat in endometrial curettage, mesothelial cell in a heart biopsy or fat in snare colon biopsy specimen.

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Report enquiry

Obtain the accession number (HPE / Lab number) and enquire for the status of the report from Histopathology Laboratory.

For biopsy cases, the requesting doctors can call the Histopathology Laboratory after three working days of specimen received in the laboratory, whereas for routine cases, the status of the report can be traced after two weeks.

The requesting doctors are welcome to discuss the cases directly with the reporting Pathologist concerned.

Request to obtain previous HPE report under Hemoline system

In order to obtain a previous report under the Hemoline system (from year 2021 backwards), the requesting doctors can call the Histopathology Laboratory to obtain the accession number (HPE / Lab number) and Pathologist in charge of the case.

A memo to request for a previous report under the Hemoline system shall be made or endorsed by a specialist and sent to Histopathology Laboratory.

A copy of the previous report can be taken by seven calendar days upon submitting the memo to the laboratory.

The previous reports of year 2022 onwards can be viewed by authorized medical staff in the web based [sistem eResults Jabatan Patologi](#) through the Hospital Pulau Pinang intranet system.

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SERVICE AFTER OFFICE HOURS

Specimen for routine histological examination will not be received after office hours.

These specimens shall be fixed in the usual manner and dispatched to the laboratory during the next working hours.

Frozen section service is not available after office hours.

Frozen section for transplant/cadaveric organ donations is available after office hours.

INTERDEPARTMENTAL CLINICOPATHOLOGY CONFERENCE

Histopathology Unit conducts clinicopathology conference (CPC) with the major clinical departments on a monthly basis. The schedule for the whole year is issued before every new year begins.

The clinical department concerned is required to submit the list of patients to be discussed to the Histopathology Office at least one week before the scheduled date.

Enquiries about clinic-pathology conference should be communicated directly to the Medical Officer in charge or Pathologist concerned.

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TAKING OUT ARCHIVAL PARAFFIN BLOCKS AND SLIDES FOR DIAGNOSTIC PURPOSE

All specimens sent to and officially received by the Histopathology Laboratory and diagnostic material derived from these specimens such as paraffin blocks and slides are the property of Histopathology Unit.

For certain valid reasons, the unit allows the clinician to borrow or take out the diagnostic material from Histopathology Unit, but certain procedures must be followed; -

- i. The request to borrow the diagnostic material must be made by a specialist.
- ii. The requesting specialist needs to fill up a form REQUEST FOR PATHOLOGY RELATED MATERIAL (HPP/PATr/HP/SD/216) which is available at the Histopathology Laboratory.
- iii. The completely filled form should be submitted to the Histopathology Laboratory and the material can be taken by 7 – 14 working days upon submitting the form to the laboratory.
- iv. The paraffin block and stained slides must be returned to the Histopathology Laboratory within 3 months.

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TAKING OUT TISSUE FROM HISTOPATHOLOGY UNIT

All specimens sent to and officially received by the Histopathology Laboratory are the property of Histopathology Unit.

In some cases, the Histopathology Unit allows the patient to take their tissue, organ or limb back, but certain procedures must be followed; -

- i. The patient or next of kin must make a request and fill up a *PERMOHONAN MENGAMBIL BALIK SPESIMEN* form (HPP/PATr/HP/SD/145 – Pind.1/19). This form is available at the Histopathology Laboratory.
- ii. The completed form should be submitted to the Histopathology Laboratory.
- iii. The tissue is released only after one month the specimen is being examined by the Pathologist and adequate sampling has been taken for reporting.

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REQUEST TO OBTAIN MICROSCOPIC IMAGE FROM HISTOPATHOLOGY UNIT

Microscopic images are not archived as routine, but images can be provided upon request.

A request shall be made or endorsed by a specialist.

For the purpose of presentation:

- The requesting doctor should communicate directly with the Pathologist concerned.
- The requesting specialist needs to fill up a form REQUEST FOR PATHOLOGY RELATED MATERIAL (HPP/PATr/HP/SD/216) which is available at the Histopathology laboratory.
- The completely filled form should be submitted to the Histopathology laboratory and the material can be taken by 7 – 14 working days upon submitting the form to the laboratory.

For the purpose of publication:

- The requesting doctor shall communicate directly with the Pathologist concerned followed by filling up the request form as for the purpose of presentation above.
- The abstract of the publication should be provided and the Pathologist concerned should be included as co-author
- The images will be available within 2 weeks upon submission of the form. Only soft copy of the images will be provided, and the requestor should provide a CD / USB pen drive before collecting the images from the unit.

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LIST OF SERVICES PROVIDED

TEST	CONTAINER	SPECIMEN	VOLUME	APPOINTMENT
Histopathology specimen: - <ul style="list-style-type: none"> • Small biopsies • Big specimens • Bones 	Universal container with 10% NBF	Tissue	1:10 ratio	Not applicable
Frozen section	Universal container	Fresh tissue	Not applicable	Yes
Immunofluorescence tests for skin and renal biopsies	Universal container	Fresh tissue	At least 3 mm core cortex for renal IF	Not applicable
Bone marrow trephine biopsies	Universal container with 10% NBF	Bone marrow	1 cm	Not applicable

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CUSTOMER CHARTER

HISTOPATHOLOGY LABORATORY

DEPARTMENT OF PATHOLOGY

HOSPITAL PULAU PINANG

NO.	TESTS	LTAT
1	URGENT SPECIMEN (Small specimen which do not require any further investigation such as immunohistochemistry test, histochemistry test, deeper level, regrossing or second opinion.)	3 WORKING DAYS
2	ROUTINE SPECIMEN	14 DAYS
3	FROZEN SECTION SPECIMEN	≤45 MINUTES (FOR EACH SECTION)

NOTE:

- i. LTAT for all of the above will start from the time of the specimen received in Histopathology laboratory until the report validated in the LIS or dispatched as stated in the Histopathology laboratory dispatch book.
- ii. LTAT for Histopathology report is subjected to the number of staff available, further investigation ordered, regrossing, second opinion and total number of cases/workload received.

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OPERATING HOURS:

Day	Morning	Afternoon
Monday-Thursday	8.00 am – 1.00 pm	2.00 pm – 5.00 pm
Friday	8.00 am – 12.15 pm	2.45 pm – 5.00 pm

CONTACT US AT:

Head of Unit	Ext 5262
Pathologists	Ext 5149 / 5262 / 5480
Medical officers	Ext 5650 / 5262
Scientific officers	Ext 5054
Histopathology Laboratory	Ext 5101



CHAPTER V: **CYTOPATHOLOGY**

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CYTOPATHOLOGY

INTRODUCTION

The Cytopathology discipline involves the morphologic study of cells, and is divided into: -

- a) **Exfoliative cytology**, which involves examination of specimens containing exfoliated cells, e.g.: cervical smears, sputum, urine, pleural fluid, peritoneal fluid, cerebrospinal fluid, and washings.

- b) **Aspiration cytology**, which involves examination of cells obtained by fine needle aspiration (FNA) and brushings.

- c) **Seminal Fluid Analysis (SFA)**, which involves examination of health and viability of a man's sperm.

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LIST OF TESTS PROVIDED

The following services are provided: -

1. Exfoliative cytopathology:
 - a) Gynaecologic Pap smear.
 - b) Body fluids.

2. Aspiration cytopathology:
 - a) Fine needle aspiration (FNA).
 - b) Brushings.

3. Seminal Fluid Analysis (Only on Thursday by appointment from Urology Department & Gynaecology Department).

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REQUEST FORM

The PER-PAT 301 request form must be used. All relevant clinical information must be provided such as clinical history, physical examination, working clinical diagnosis, imaging findings, intra-operative findings (e.g. fluid obtained during FNA), previous cytology diagnosis, previous chemotherapy or radiotherapy, before sending the specimen to the laboratory.

If urgent result is required, please indicate on the form by marking “URGENT” in red.

All Pap smear requests should be written in the new ‘Bethesda’ request & reporting form, PS 1/98 (Pindaan 2023).

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COLLECTION OF SPECIMENS

Body Fluids / Cerebrospinal fluid (CSF)

1. Specimens should be collected in sterile containers and sent to the laboratory for urgent processing.
2. For CSF specimen: If there is a delay of more than 12 hours, 50% ethyl alcohol should be put into specimen container as fixative (volume of alcohol similar to that of specimen).
3. Most fluids (except CSF and urine) are reasonably preserved for 48 to 72 hours in refrigerator.
4. If a large volume is collected, please send all to the Cytology Laboratory as cell block preparation can also be done.

Bronchial Aspirate and Washing

Specimen is collected and is sent to the Cytology Laboratory immediately.

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Bronchial Brushing / Gastric Brushing

Brush should be rotated gently but rapidly on a small area of the slide and smear is fixed in 95% ethyl alcohol immediately and dispatch to the laboratory.

Fine Needle Aspiration for Cytology (FNAC)

1. Appointment for FNAC should be made by the specialist by contacting the cytotechnologist at Ext. 5650.
2. For Urgent FNAC request, contact the pathologist at Ext. 5262 / 5149.
3. FNA procedure can only be done by a specialist or trained medical officer from the requesting department.
4. Please fill in the request form legibly, complete with the clinical history and findings and the clinician's name. Consent must be taken by the operator (specialist / medical officer) before the procedure is done.

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Nipple Secretions

Specimen should be collected by applying the slide directly to the nipple, followed by immediate fixation / air drying. Fix in 95% ethyl alcohol and dispatch to the laboratory.

Pap Smears

1. Specimen must be collected prior to bimanual examination.
2. Unlubricated speculum should be used. Water may be used if necessary.
3. No douching or sexual intercourse should be performed prior to specimen collection.
4. Specimen collected is smeared on a glass slide and immediately fixed in 95% ethyl alcohol.
5. Specimen collected for Liquid Based Cytology method should be put in Liquid Based Cytology solution bottle provided.
6. Method of collection is as provided in the national Pap Smear Guidelines Book.

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How to take a Cervical Smear (Conventional Smear)

1. Complete the cytology PS 1/98 (Pindaan 2023) and label the slide.
2. Wash your hand and wear gloves.
3. Examine the client in a dorsal position.
4. Swab the introitus with normal saline.
5. Wet the bivalve speculum using sterile water or normal saline (**Do not use lubricant**).
6. Introduce the speculum into the vagina carefully avoiding contact with the cervix (any bleeding from the cervix will limit accurate evaluation of the smear).

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7. Expose the cervix clearly.

- a) Take sample from the cervix using the long end of the Ayre’s spatula which is turned carefully around the cervix (360° – one complete circle).

OR

- b) Take sample from the cervix using the long end of the broom-like apparatus. The central bristles of the broom are inserted into the endocervical canal until the lateral bristles bend fully against the ectocervix (The broom is rotated 360° in the same direction (5) times while maintaining gentle pressure).

8. Smear the sample on the labelled slide.

9. Take another sample if necessary (e.g. menopausal women) from the endocervical canal using a cytobrush which is turned carefully around the cervical canal (360° – one complete circle). The end part of the bristle must be visible when taking sample using the cytobrush. Roll the brush on the slide.

10. Dip the slide immediately into a Coplin jar containing a fixative (95% ethyl alcohol) for 30 minutes or spray the slide using an alcohol spray fixative. Ensure the whole sample is sprayed with fixative.

11. Place the slide/s in the slide mailer then send the slide/s and request form/s to the laboratory.

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How to take a Cervical Smear (Liquid Based Cytology)

1. Perform step 1 to 7 in the **conventional** smear instruction. If necessary, step 1 to 6 and 9.

2. After the collection,
 - a) Rinse the broom by pushing it into the bottom of the vial 10 times, forcing the bristles apart. Then, swirl the broom vigorously to release more material.

 - OR**
 - b) Rinse the cytobrush by swirling it vigorously in the vial 10 times. Discard the cytobrush.

3. Close the cap tightly on the vial/s and send the specimen along with the form/s to the laboratory.

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Sputum

1. Morning specimen is required i.e. before breakfast after rinsing mouth with water.
2. Deep cough specimen is required.
3. Cough into a mouth receptacle and dispatch immediately for processing.
4. If there is delay, sputum can be collected into a container with 50% alcohol (15 to 20 ml) as fixative.
5. Three samples are required to eliminate false negative and if possible, a few days apart.

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Urine

1. A catheterized specimen is preferred.
2. Collect random urine specimen directly into a clean container and dispatch to the laboratory for processing.
3. Fresh specimens, between 1 and 12 hours old, do not need fixation. If the duration of transport takes 12 to 24 hours, refrigeration is recommended.
4. If there is a delay of more than 24 hours, collect in an equal volume of 50% ethanol and dispatch.

Urine Cytology (For Non-Catheterized Specimen)

1. Instruct the patient to discard first morning voided urine.
2. After the first morning voided urine, instruct patient to keep hydrated by drinking water.
3. Mid-stream urine is preferred, instruct the patient to pass some urine into the toilet. Then, without stopping the flow of urine, catch some urine in a clean (sterile) bottle. Once enough, urine is collected in the bottle, finish off passing the rest of the urine into the toilet.
4. After collection, close the lid tightly and put the bottle in the sample bag provided together with the laboratory request form.
5. Send the specimen to the laboratory.

NOTE: Use of fixative is not encouraged as it can cause changes in the specimen collected. It is highly recommended to send freshly collected specimen as soon as possible to the Cytology Laboratory.

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Seminal Fluid Analysis

Collection of Semen

1. **Time for receiving semen specimen: Scheduled dates (every Thursday), before 9 AM (excluding public holiday).**
2. Collection should follow a period of sexual abstinence of 3-7 days.
3. The specimen is collected by masturbation or by coitus interruptus without the use of aids like condoms etc into a sterile screw-capped bottle.

NOTE:

- a) Condoms, even when thoroughly washed and rinsed, contain spermicidal agents, and must not be used. Exposure of spermatozoa to cold and heat should be avoided.
- b) Note the date and exact time when the specimen is obtained.
- c) The material should be examined within 1-3 hours.

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DISPATCHING SPECIMENS

1. All specimens must be labelled clearly and should bear the same identification as that written on the request forms.

2. All specimens should be sent to the Cytology Laboratory (in OPD Laboratory – 001) immediately during office hours, to prevent morphological changes to cells.

3. **After office hours, the specimen can be sent to the Main Laboratory Counter of the Pathology Department (009B). (Not recommended for CSF and Urine Cytology). Urine Cytology collected more than 24 hours without preservative will be rejected.**

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REPORTING RESULTS

Reports are available within (Laboratory turn-around time, LTAT): -

- a) 30 working days for routine Gynae cases (Pap smear).
- b) 7 working days for urgent Gynae cases (Pap smear).
- c) 7 working days for routine FNA and Non-Gynae cases / other fluids.
- d) 3 working days for urgent FNA and Non-Gynae cases / other fluids.
- e) 1 working days for SFA.

NOTE:

- The above LTAT depends on the number of pathologists on duty in the laboratory.
- The time frame is calculated from the time the specimen received at the Cytology Laboratory.

Verbally informing Cytology diagnosis by technical staff over the phone is prohibited. The doctor in-charge of the patient should contact the Pathologist directly.

DISPATCHING RESULTS

1. All reports can be viewed by authorized medical staff in the web based [sistem eResults Jabatan Patologi](#) through the Hospital Pulau Pinang intranet system.
2. The Pap smear reports from Health Clinics (PKBD, PKTL, SPU and SPT) will be placed in envelope available for collection in Cytopathology Laboratory.

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SERVICE AFTER OFFICE HOURS

1. There are no Cytology services available after office hours. Clients are encouraged to plan ahead for any request for Cytology specimen to be sent during office hours.
2. If specimen collected outside office hours, it should be refrigerated at 2°C - 8°C before being dispatched to the Cytopathology Laboratory in the morning on the next working day.

OR

After office hours, the specimen can be sent to the main laboratory counter of the Pathology Department (009B).

(CSF & Urine cytology may deteriorate after 24 hours even with refrigeration).

3. DO NOT PUT SPECIMENS IN THE FREEZER.

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SPECIFIC REJECTION CRITERIA FOR CYTOLOGY REQUEST

Generally, any specimen which does not fulfil the criteria for specimen collection, dispatch and transportation will be subjected to rejection / hold on for verification. The following list of rejection criteria consists of the common rejection scenarios in Cytopathology unit (other than the general criteria listed on page 23):

- The correct request form should be used for Pap smear request which is PS 1/98 (Pindaan 2023). PER-PAT 301 form is to be used for any other cytology request.
- Seminal Fluid Analysis (SFA) requested by department other than Urology Department and Gynaecology Department will be rejected.
- Urine cytology without preservative will be rejected, if the specimen is more than 24 hours.
- If multiple urine cytology requests are sent from the same patient and same collection time, only one specimen will be processed. The rest will be rejected.

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**LIST OF TESTS
CYTOPATHOLOGY LABORATORY
DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG**

NO	TEST	CONTAINER	APPOINTMENT
1	FNAC	Slide / Universal container	Yes
2	Pap Smear	Slide / LBC vial	No
3	Non-Gynae smear	Slide / Universal container	No
4	Seminal Fluid Analysis (SFA)	Universal container	Yes <i>*Only on Thursday from the Urology Department and Gynaecology Department</i>

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**CUSTOMER CHARTER
CYTOPATHOLOGY LABORATORY
DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG**

NO.	TYPE OF TESTS	LTAT
1	<u>FNAC</u> URGENT NON-URGENT FNAC WITH CELL BLOCK	3 WORKING DAYS 7 WORKING DAYS 15 WORKING DAYS
2	<u>PAP SMEAR</u> URGENT NON-URGENT	7 WORKING DAYS 30 WORKING DAYS
3	<u>NON-GYNAE</u> URGENT NON-URGENT NON-GYNAE WITH CELL BLOCK	3 WORKING DAYS 7 WORKING DAYS 15 WORKING DAYS
4	SEMINAL FLUID ANALYSIS (SFA)	1 WORKING DAY

NOTE:

1. LTAT for all of the above will start from the time of the specimen received in Cytology laboratory.
2. LTAT for the ABNORMAL smear is subjected to number of pathologists available.
3. For technical assistance of FNAC or ROSE (rapid on site evaluation) in ward / clinic / OT / Radiology department (not including the scheduled session in specialist clinics) please contact us at ext. 5650.
4. Seminal Fluid Analysis is only done as scheduled by the Urology Department and Obstetrics & Gynaecology Department.



CHAPTER VI: **HAEMATOLOGY**

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HAEMATOLOGY

INTRODUCTION

Haematology Laboratory is part of the Pathology Department. The unit provides diagnostic and consultation services that cover analysis and interpretation of blood and body fluids such as bone marrow and CSF fluid for screening, diagnosis, and monitoring of diseases.

The lab is divided into two sections:

1. Routine Haematology Laboratory
2. Special Haematology Laboratory

Summary of tests offered in these laboratories as below.

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Section	Test Offered	Operating Hours	Ext. No
Routine Haematology Laboratory	1. FBC 2. Basic Coagulation: a. Prothrombin Time (PT) / Activated Partial Thrombin Time (APTT) b. Fibrinogen (FBG) c. D-Dimer 3. G6PD screening test 4. ESR	24 hours	5146
	1. Full Blood Picture (FBP) 2. Advanced Coagulation Tests: a. Inhibitor assay b. FVIII, FIX assay c. vWF:Ag, vWF:Rco assay d. Lupus Anticoagulant	8 am-5 pm (After office hour: please consult pathologist oncall for urgent cases)	5146 MO: 5639
Special Haematology Laboratory	1. Bone marrow aspirate 2. Leukemia/Lymphoma Immunophenotyping 3. CD4/CD8 enumeration 4. CSF for blast 5. PD fluid for differential counts 6. Kleihauer Test 7. Molecular Quantitation Major <i>BCR::ABL1</i> (p210) 8. Hb analysis	8 am-5 pm	5652

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TESTS INDICATION AND REQUIREMENT

1. ROUTINE HAEMATOLOGY LABORATORY

Full Blood Count (FBC)

Indication:

- One of the routine tests in haematology used to diagnose and monitor medical conditions such as anemia, bleeding disorders, infection, inflammation, malignancy and others.
- It also helps in monitoring the effects of treatment/chemotherapy or transfusion of blood components.

Requirement:

- Collect the sample in one EDTA tube. Please ensure that the sample volume is adequate. Avoid removing the cap of the sample during the blood collection process. Advice using a vacutainer to fill the tube.
- Please ensure proper sample mixing post venepuncture. Clotted or hemolysed samples will be rejected.
- Please send the sample immediately to the lab. **DO NOT KEEP SAMPLE IN THE REFRIGERATOR.** WBC counts can be reduced due to sample degradation. Platelet counts can be reduced due to activation or clumping. In cold temperature, patients with cold agglutinins will develop clumping of the red cells and a consequent false elevation of the MCV, reduced RBC and increased mean cell haemoglobin concentration (MCHC)
- Morphological review (slide review) will be performed if analytical flagging or warning is generated (e.g. suspected presence of platelet clump or abnormal cells). In this case, a preliminary FBC report will be released with a comment to

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await a slide review report. Since morphological assessment of the sample has been done, requests for FBC for the patient will be rejected.

- Slide review report will not include comments or impressions as most of FBC requests lack clinical information and diagnosis.
- In certain cases (e.g. suspected hemolysis or new leukaemia case), slide review will be converted to Full Blood Picture (FBP). A new request form with full clinical history is needed (**no new sample is required**).

Full Blood Picture (FBP)

Indications:

- For paediatrics and adult hemato-onco cases.
- In cases with unexplained cytopenia/cytosis.
- Suspicion of hematological malignancy based on symptoms, clinical examination and FBC findings eg: Acute/Chronic leukaemias, MPN, MDS, LPD
- Pathological jaundice in neonates
- Clinical suspicion of haemolysis. e.g.: -
 - i. TRO Microangiopathic Haemolytic Anaemia (MAHA), Haemolytic Uraemic Syndromes, atypical Haemolytic Uraemic Syndromes (aHUS)
 - ii. Red cell fragmentation Syndromes
 - iii. Oxidative Haemolysis
 - iv. Warm or Cold Autoimmune Haemolytic Anaemia (AIHA)
 - v. Haemolysis due to red cell membrane disorder

* Please include other haemolysis parameters (eg LDH, Coombs test) in request form.

Not indicated:

- Post transfusion sample unless sent as part of the investigation for suspected haemolytic transfusion reaction.

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- Investigation of anaemia with clinical evidence of recent bleeding or underlying iron deficiency anaemia.
- Suspicion of thalassemia/hemoglobinopathy – please send for Hb analysis instead.
- Physiological/dilutional anemia in pregnancy.
- If slide review has been done previously (within 7 days) and there is no significant changes in the blood count.

Erythrocyte Sedimentation rate (ESR)

Indication:

- The ESR test measures the rate at which the red blood cells (RBCs) in a whole blood sample fall to the bottom of the tube.
- The red blood cells typically fall at a faster rate in people with inflammatory conditions such as infections, cancer, or autoimmune disorders.
- This test used to screen and monitor an increase in inflammatory activity within the body caused by one or more conditions such as autoimmune disease, infections, or tumors.

Requirement:

- Whole blood collected in a dry and clean ESR vacuum glass tube. Ensure adequate sample volume. Refer to volume indicator on the tube.
- Please send sample immediately to lab. **DO NOT KEEP SAMPLE IN THE REFRIGERATOR.** Otherwise ESR will be reduced due to the increase in plasma viscosity at cooler temperatures.

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Glucose-6-phosphate dehydrogenase (G6PD) fluorescent spot test

Indication:

- Neonatal screening test for G6PD deficiency.
- Screening for G6PD deficiency in patient with history of oxidative haemolysis.

Requirement:

- One drop of whole blood is placed on a piece of filter paper or sample in an EDTA tube.
- Not to send samples during acute haemolytic episodes or post transfusion as this can cause falsely normal results.
- Please pack each sample **separately** using a biohazard bag. Failure to do so could cause the filter papers to stick to each other and will be rejected.

Basic Coagulation Test

I. First line investigations: PT, APTT, Fibrinogen

Indication:

Generally used as a first step in investigation of an acutely bleeding patient, a person with a suspected bleeding tendency or as a precaution before an invasive procedure is carried out.

- However, these tests have limited sensitivity for presence of significant bleeding diathesis (e.g. von Willebrand disease or disorders of platelet or vessels).
- Hence a normal 'clotting screen' should not be taken to mean that hemostasis is normal.

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- The use of a structured patient interview or questionnaire before surgery or invasive procedures to assess bleeding risk has been recommended in international guidelines.
- This should include family bleeding history, and personal bleeding history, including previous excessive post-traumatic or post-surgical bleeding; and detailed information on the patient's medication including complementary medications.
- A number of Bleeding Assessment Tools (BATs) are available for this purpose. Please click the link provided to access the ISTH-SCC Bleeding Assessment Tool.
- <https://www.mdcalc.com/calc/10580/isth-scc-bleeding-assessment-tool>

Requirement:

- Sample in one sodium citrate tube. Please ensure sample volume is adequate.
- Blood is collected in 1 anticoagulant: 9 blood ratios.
- Clotted, lipemic and icteric sample will be rejected.
- Please refer to **Special requirement for Coagulation Test (page 129)** for details.
- Please send sample immediately to lab. **DO NOT KEEP SAMPLE IN THE REFRIGERATOR.** Storing whole blood in the refrigerator prior to processing is not recommended for most coagulation test due to the potential for cold precipitation of clotting factors including fibrinogen, vonWillebrand factor (vWF) and factor VIII as well as cold activation of factor VII and FXII causing shortening of activated partial thromboplastin time (APTT) and especially prothrombin time (PT).

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II. Second line investigations: Mixing test, Factor assays, Von Willebrand assays, Inhibitor Assay, Lupus Anticoagulant

Indication:

- Relevant second line investigations required depend on the patterns of abnormalities detected by first-line tests. Please refer below: -

i. Factor assay (Factor VIII, Factor IX)

- To quantify factor VIII or IX activity level in patient with bleeding history, monitor level in known haemophilia and for family screening.
- Sample in one (1) citrated tube is adequate. Please ensure sample volume is adequate.

ii. Von Willebrand assay (VWF:Antigen, VWF: activity (Ricof))

- Investigation in patient with significant bleeding history, first degree relative of a patient with Von Willebrand Disease or clinically suspected of Von Willebrand Disease.
- Please indicate Bleeding Score from a validated Bleeding Assessment Tool as the initial screening test.
- Please click the link provided to access the ISTH-SCC Bleeding Assessment Tool.
<https://www.mdcalc.com/calc/10580/isth-scc-bleeding-assessment-tool>
- Please avoid ordering test during acute phase (ie; bleed, trauma, pregnancy) as VWF is an acute phase. VWD diagnostic testing should be performed when patients are at a baseline state of health.
- Sample in one (1) citrated tube is adequate. Please ensure sample volume is adequate.

iii. Inhibitor assay

- To confirm and quantify inhibitors of coagulation factor in congenital and acquired haemophilia.
- Refer to the latest haemophilia CPG for frequency of test.
- Sample in four (4) citrated tubes is required. Please ensure sample volume is adequate.

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iv. Mixing test

- The first line investigation of an abnormal screening test, typically a prolonged activated partial thromboplastin time and/or a prolonged prothrombin time
- When mixing test results shows correction of clotting time, this is suggestive of clotting factor(s) deficiency. Non-correction of clotting time suggests the presence of an inhibitor (e.g factor inhibitor or lupus anticoagulant) or other type of interference (e.g., the presence of an anticoagulant such as heparin).
- Requires sample in two (2) citrated tubes. Please ensure sample volume is adequate.
- **NOTE:** Mixing test is not a requested test. It is done as part of laboratory investigations of prolonged APTT or PT and guides the lab on further test to proceed (e.g factor assay, inhibitor assay or lupus anticoagulant test).

v. Lupus Anticoagulant

- To identify lupus anticoagulant in suspected antiphospholipid syndrome, part of risk assessment of SLE or as part of investigation for isolated prolonged APTT.
- Send sample in two (2) citrated tubes. Please ensure sample volume is adequate.
- Rejection criteria please refer below:
 - a) Patients who plan for continuing anticoagulant treatment
 - b) Patients who had provoked VTE (e.g., surgery, immobilisation, trauma, pregnancy)
 - c) Asymptomatic person who had first degree relative of DVT, PE or thrombophilia²
 - d) Patients on anticoagulant- should be discontinued as below:
 - (i) Warfarin: 2 weeks after discontinuation
 - (ii) UFH: 24 hours post dose
 - (iii) LMWH: 24 hours post dose (min 12 hours)
 - (iv) DOAC: 72 hours post dose (min 48 hours)
 - e) During acute episode of thrombosis (6 weeks) unless suspect catastrophic APS or new stroke and suspect APS¹
 - f) During pregnancy or 6 weeks postpartum³

¹.Devreese KMJ et al.. Guidance from the Scientific and Standardization Committee for lupus anticoagulant/antiphospholipid antibodies of the International Society on Thrombosis and Haemostasis: Update of the guidelines for lupus anticoagulant detection and interpretation. J Thromb Haemost. 2020 Nov.

².Arachchilage, DJ et al. Thrombophilia testing: A British Society for Haematology guideline. Br J Haematol. 2022.

³.Tektonidou MG et al. EULAR recommendations for the management of antiphospholipid syndrome in adults. Ann Rheum Dis. 2019 Oct;78(10):1296-1304.

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D-dimers Quantitative Test

Indication:

- The principal utility of measuring D-dimer is the high negative predictive value of the test in the diagnosis of venous thromboembolism (VTE).
- It is also valuable in the diagnosis and the monitoring of DIC in combination with other parameters.
- D-dimers may be produced in many illnesses and conditions associated with thrombosis and thrombolysis
- Therefore, the result of this test should always be interpreted with the patient's medical history, clinical presentation and other investigations.
- For VTE exclusion.
- D-Dimer should always be used within the context of pretest likelihood for VTE (e.g.: Well's score). Test indicated for patients with low clinical probability e.g. DVT Well's score < 2, PE Well's score ≤ 4.
 - * **Non indicated cases will be rejected.**
- Patients with subsegmental/peripheral PE or distal DVT may have a normal D-dimer results
- D-dimer levels naturally increase with age and in pregnancy, therefore a corrected D-dimer cut-off value is suggested for patients above 50 years old or pregnant patients.
- Judicious ordering of D-dimer assays should be practiced.
- Serial D-dimers are not usually requested.

Requirement:

- Sample in one (1) sodium citrate tube is adequate.
- Blood is collected in 1 anticoagulant: 9 blood ratio.
- Clotted, lipemic and icteric samples will be rejected.

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DVT Wells score

Clinical feature	Points
Active cancer (treatment ongoing, within 6 months, or palliative)	1
Paralysis, paresis, or recent plaster immobilisation of the lower extremities	1
Recently bedridden for 3 days or more, or major surgery within 12 weeks requiring general or regional anaesthesia	1
Localised tenderness along the distribution of the deep venous system	1
Entire leg swollen	1
Calf swelling at least 3cm larger than asymptomatic side	1
Pitting oedema confined to the symptomatic leg	1
Collateral superficial veins (non-varicose)	1
Previously documented DVT	1
An alternate diagnosis is at least as likely as DVT	-2

PE Wells Score

Clinical feature	Points
Clinical signs and symptoms of DVT (minimum of leg swelling and pain with palpation of the deep veins)	3
An alternate diagnosis is less likely than PE	3
Heart rate more than 100 beats per minute	1.5
Immobilisation for more than 3 days or surgery in the previous 4 weeks	1.5
Previous DVT/PE	1.5
Haemoptysis	1
Malignancy (on treatment, treated in the last 6 months, or palliative)	1

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SPECIAL REQUIREMENT FOR COAGULATION TEST

1. Coagulation tests are time dependent, therefore please state the time sample is taken.
2. Please provide diagnosis, brief clinical history (including bleeding history) and drugs history in request form.
3. For patient with haematocrit >55%, the sample needs to be collected in a tube with adjusted citrate volume. Please call ext. 5146 for a new citrate tube.
4. Summary of recommendations for blood collection and handling for coagulation test*:
 - Perform clean venipuncture with minimal stasis.
 - Use a 21-gauge needle or butterfly (19 gauge may be used in adults with good veins; 23 gauge may be required for infants).
 - Do not use heparin-contaminated venous lines. Where this is unavoidable because of poor venous access, flush the line with crystalloid and discard the first few millilitres of blood (the first 5 ml).
 - Use 0.105–0.109 M tri-sodium citrate (9 volumes blood to 1 volume anticoagulant).
 - Ensure correct filling of tube (fill at least up to minimum indicator level). Refer Image H1 below for example. **Please note that different tube brand has different fill indicator.**
 - Please ensure the tube has not expired as the amount of citrate in expired tube could be reduced significantly.
 - Blood and anticoagulant should be mixed immediately by gentle inversion 5–6 times. Do not shake or vigorously mix the sample as this could cause haemolysis and activation of the clotting factors.
 - Transport blood samples rapidly (ideally within 1 hour) at room temperature.

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

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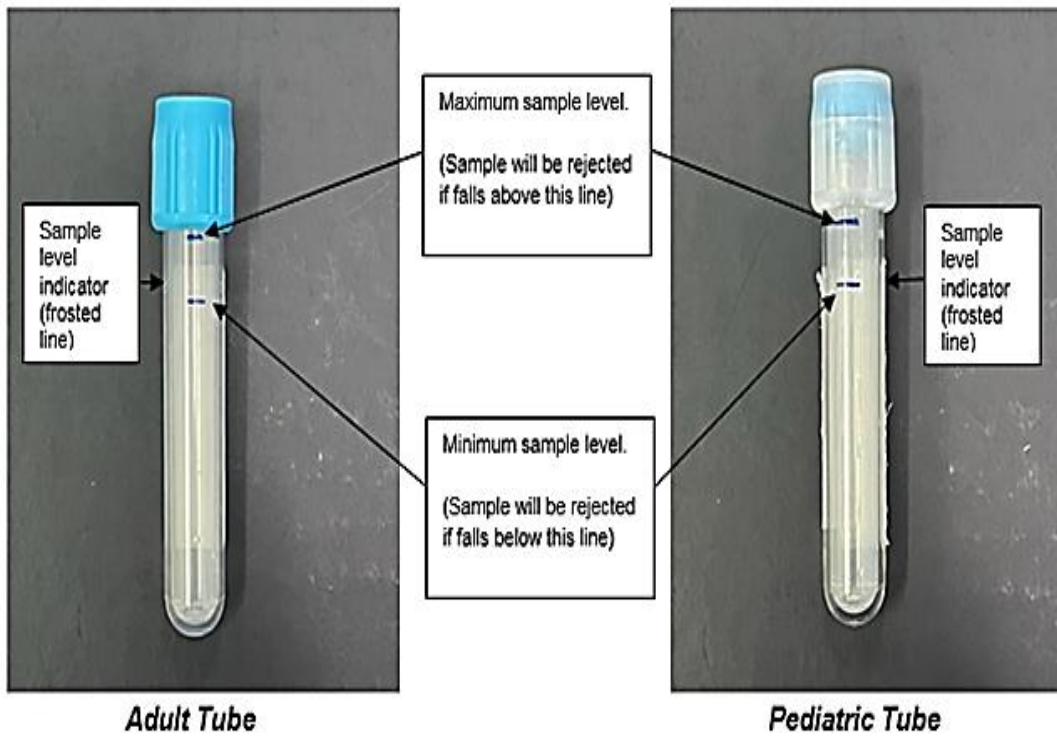


Image H1: Sample Requirement for Adult and Paediatric Tube

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2. SPECIAL HAEMATOLOGY LABORATORY

Bone marrow aspirate

Indication:

- Cytological assessment of bone marrow cells where individual cells can be recognised, classified and counted.
- It has a major value in assessment of abnormal cell maturation, cytological classification and numerical assessment of haematological malignancies.
- Bone marrow aspirate examination also helps in monitoring progression and treatment of patients.

Requirement:

- Booking for bone marrow procedure with Special Haematology laboratory staff at bone marrow section with a proposed date. BMA for cases from non-haematological ward/clinic needs to be discussed with Pathologist in charge or Clinical Haematologist, while paediatric cases should be discussed with Paediatric Oncologist.
- Request form with complete clinical history and countersigned by the Clinical Specialist must be sent to the laboratory. The request form must reach the lab a day before the procedure.
- For urgent appointment, please discuss with the Pathologist in charge.
- During the procedure:
 - To preserve morphology, the syringe should not contain anticoagulant.
 - Approximately 0.5 ml of the first draw of the aspirate should be collected as with increasing volumes of bone marrow aspirate drawn, there is progressive dilution of the aspirate with peripheral blood.
 - Labelling of the bone marrow samples must be done by the doctor in charge at bedside. Samples must be sent to the lab by the clinic/ward staff.

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Immunophenotyping

Indication:

- For diagnosis of haematopoietic malignancy (leukaemia and lymphoma) and monitoring of minimal residual disease in B-acute lymphoblastic leukaemia (B-ALL).

Requirement:

- Booking with Special Haematology laboratory staff at bone marrow section with a proposed date.
- Request form with complete clinical history and countersigned by the Clinical Specialist must be sent to the laboratory. The request form must reach the lab a day before the procedure.
- For urgent appointment, please discuss with the Pathologist in charge.
- For MRD: Please take the first 0.5 - 1.0 ml (in EDTA tubes) of bone marrow aspirate sample (first pull sample) before smear sample.
- For diagnostic immunophenotyping, 2-3 ml aspirate sample (in EDTA tubes) to be taken after the smear sample.
- For peripheral blood immunophenotyping, requires (2) EDTA tubes, minimum 2ml blood in each tube.
- Please send the sample as soon as possible to the lab as prolonged storage will lead to loss of cell populations or antigen expression.

CD4/CD8 enumeration

Indication:

- Enumeration of CD4 and CD8 in diagnosis and monitoring of patients with human immunodeficiency virus infections.

Requirement:

- Sample collected in one (1) EDTA tube.
- Request form must be signed or countersigned by Infectious Disease Specialist or Medical Specialist for samples from district hospitals.
- Test will be run on Monday – Thursday (Office Hours only)
- Samples received by laboratory on Friday, the weekends or public holidays will be rejected.

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Molecular Quantitation Major *BCR::ABL1* (p210)

Indication:

To quantitate *BCR::ABL1* and *ABL1* mRNA transcripts in peripheral blood specimens of diagnosed t(9;22) positive Chronic Myeloid Leukemia (CML) patients expressing BCR-ABL1 fusion transcript type e13a2 and/or e14a2.

Requirement:

- Booking with Special Haematology laboratory staff at Molecular BCR-ABL section with a proposed date must be done before taking the sample.
- Minimum 3 tubes of 2mL EDTA peripheral blood samples.
- Please ensure adequate sample mixing post venipuncture.
- Request form must be filled with relevant clinical history (eg; date of diagnosis, current treatment, date of initiation of current treatment, change in treatment) and countersigned by the Clinical Specialist.
- For new case, please attach together with a diagnostic molecular report.
- Test only be done on **Tuesday** and **Thursday**. Please make sure booking have been done before sending the sample.

CSF for Blast

Indication:

- To look for the presence of blast cells in cerebrospinal fluid (CSF).

Requirement:

- Sample collected in sterile specimen container and sent to laboratory immediately to avoid storage changes.
- Sample must reach the laboratory before 3pm. Please inform the laboratory if sample need to be sent after 3pm.

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PD Fluid for Differential Counts

Indication:

- For manual differential counts of white blood cells in peritoneal dialysis (PD) fluids.

Requirement:

- Samples should be collected in the sterile urine container and sent to the laboratory immediately.

Kleihauer Test

Indication:

- To detect the presence of cells containing fetal haemoglobin in maternal circulation.

Requirement:

- Sample collected in one (1) EDTA tube.
- Please take **maternal sample**.

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Hb Analysis

Indication:

- Screening test for thalassaemia/ haemoglobinopathy. The test is able to quantitate HbA, HbA2, HbF and detect, quantitate and identify variant haemoglobins.
- Form 4 student screening as part of the National Thalassaemia Screening program.

Requirement:

- No recent blood transfusion within the last 3 months.
- Baseline iron status (if anaemic) to exclude underlying iron deficiency.
- For cascade screening, details of the index case must be included in the request form. Details of the index case need to include Name, IC, Diagnosing Laboratory, Diagnosis and relationship of the index case to the client.
- Hb analysis for children less than 2 years old is not recommended unless urgent cases where diagnosis is crucial for management of patient e.g.: Thalassaemia major or intermedia.

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SUMMARY OF TEST REQUIREMENT AND LABORATORY TURN AROUND TIME (LTAT)					
No.	Test	Tube	Request Form	Notes	LTAT
Routine Haematology Test					
i.	Full Blood Count (FBC)	1 EDTA Tube	Per-PAT 301	DO NOT KEEP SAMPLE IN FRIDGE	Urgent: 45 minutes Non urgent: 2 hours
ii.	Slide review	NA	NA	Reflex test done by laboratory	24 hours
iii.	Full Blood Picture (FBP)	1 EDTA Tube	Per-PAT 301	Clinical history is required Only done during office hours except for urgent cases.	Urgent: 1-3 working days Non-Urgent: 7 days

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iv.	Coagulation Profile (PT/APTT)	1 Sodium Citrate Tube	Per-PAT 301	Test should be performed as soon as possible after collecting the sample. (please state time sample taken) DO NOT KEEP SAMPLE IN FRIDGE	Urgent: 1 hour
v.	Fibrinogen (FBG)	1 Sodium Citrate Tube	Per-PAT 301		Non urgent: 2 hours
vi.	Erythrocyte Sediment Rate (ESR)	1 ESR Tube	Per-PAT 301		2 hours
vii.	D-Dimer	1 Sodium Citrate Tube	Per-PAT 301		2 hours
viii.	G6PD Screening	Filter Paper or EDTA tube	Request Slip		-

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Special Coagulation Test					
i.	Factor Assay (FVIII / FIX)	1 Sodium Citrate Tube	Per-PAT 301	Urgent case - Please consult pathologist. Non urgent case - Please send sample during office hours, preferably in the morning	Urgent: 24 hrs Non-urgent: 7 days
ii.	Inhibitor Assay	4 Sodium Citrate Tube	Per-PAT 301		3 working days
iii..	Lupus Anticoagulant	2 Sodium Citrate Tube	Per-PAT 301	Sample run in batches.	1 week
iv.	Von Willebrand factor assay (vWF : Ag / vWF : Rcof)	1 Sodium Citrate Tube	Per-PAT 301	For new case: Clinical history including Bleeding score is required	1 week

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No.No.	Test	Tube	Request Form	Notes	LTAT
Special Haematology Laboratory					
i.	Bone Marrow Aspirate	-	Per-PAT 301 (A4 Size)	By appointment	3 working days
ii.	Immunophenotyping	1 EDTA Tube	Per-PAT 301 (A4 Size)	By appointment	3 working days
iii.	Minimal Residual Disease (MRD)	1 EDTA tube	Per-PAT 301	By appointment	7 working days
iv.	CD4/CD8	1 EDTA Tube	Per-PAT 301		5 working days
v.	CSF for Blast Cells	Sterile urine container	Per-PAT 301	Sample should arrive in lab latest by 3 pm	3 working days
vi.	Kleihauer test	1 EDTA Tube	Per-PAT 301	-	3 working days
vii.	Urine for Haemosiderin	Sterile urine container	Per-PAT 301	-	3 working days
viii.	PD Fluids for Eosinophils	Sterile urine container	Per-PAT 301	-	3 working days
ix.	Molecular Quantitation Major BCR-ABL1 (p210)	3 peripheral blood in EDTA tube	Per-PAT 301	Clinical history is required. By appointment.	14 working days
x.	Hb Analysis	1 EDTA Tube	Per-PAT 301	Clinical history is required	Urgent : 2 weeks Semi Urgent : 4 weeks Non Urgent: 6 weeks

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COLLECTION TUBE AND TEST AT A GLANCE

	<p style="text-align: center;"><u>EDTA TUBE</u></p> <ul style="list-style-type: none"> - FBC - FBP - CD4/CD8 - Kleihauer test - Hb Analysis - Immunophenotyping - MRD - Molecular quantitation major BCRABL1 (p210) 		<p style="text-align: center;"><u>SODIUM CITRATE TUBE</u></p> <ul style="list-style-type: none"> - PT/APTT - D-dimer - Fibrinogen - Lupus Anticoagulant - Thrombophilia screening - Factor Assay - Von Willebrand assay - Mixing test - Inhibitor assay
	<p style="text-align: center;"><u>ESR TUBE</u></p> <ul style="list-style-type: none"> - ESR 		<p style="text-align: center;"><u>STERILE URINE CONTAINER</u></p> <ul style="list-style-type: none"> - CSF for Blast Cells - PD fluid for Differential Count - Urine for hemosiderin

CHAPTER VII:

REFERRAL LABORATORY & MAIN COUNTER

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REFERRAL LABORATORY AND MAIN COUNTER UNIT

INTRODUCTION

The Referral laboratory and Main Counter Unit (Previously known as Outsource Unit) is situated in the Pathology Department and provides services for the clinics and wards of Hospital Pulau Pinang.

All the test requested will be prepared before packaging and sent to respective referral laboratory following the specified test requirement.

LIST OF TESTS PROVIDED

- ★ Please refer to the [HPP OUTSOURCE TEST LIST](http://10.158.101.68:8056/testlist/) (<http://10.158.101.68:8056/testlist/>) for the most up to date information.
- ★ The details regarding the test code, test name, referral laboratory, sample type, test schedule, test volume, test preparation, form, method of outsourcing, LTAT and test status can be found here.
- ★ All request forms can be obtained in iLab web requiry

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DISPATCH OF SPECIMENS

Specimen should be dispatched to the laboratory as soon as possible during office hour preferably before 11 am on working days EXCEPT for molecular haematology - test is not advisable to send on Friday.

ACCESSION OF RESULTS

All inpatients and outpatients results including from Klinik Kesihatan can be viewed by authorized medical staff in the web based [sistem eResults Jabatan Patologi](#) through the Hospital Pulau Pinang intranet system or can be collected from the pigeon-hole of Department of Pathology, Hospital Pulau Pinang.

APPENDIX



APPENDIX I

LIST OF TESTS

NO	TEST	UNIT	CONTAINER	SPECIMEN	VOLUME	FREQUENCY	REFERENCE RANGE	Turn-around time (LTAT)	NOTE
1.	Acid Fast Bacilli (AFB)	Microbiology (TB Lab)	Sterile container	Sputum/ tracheal aspirate/ BAL/ tissue/Body fluid	NA	Daily		1 working day	Except stool
2.	Acetaminophen	Chem Path	Plain tube (without gel)	Blood	5 ml	Daily	Refer to individual result report form for interpretation and comment	Urgent LTAT: 1 hour	TDM request form
3.	Alanine Transaminase (ALT)	Chem. Path	Heparinised tube	Blood	5 ml	Daily	Male : 10 – 50 U/L Female: 10 – 35 U/L	LTAT: 3 hours	
4.	Albumin (Alb)	Chem. Path	Heparinised tube	Blood	5 ml	Daily	Adult : 35 – 52 g/L 0 – 4 days : 28 – 44 g/L 4 days – 14 years : 38 – 54 g/L 14 – 18 years : 32 – 45 g/L	LTAT: 3 hours	
5.	Albumin Creatinine Ratio, Urine (ACRU)	Chem. Path	Universal container	Urine	First morning urine 20 ml	Daily	Spot urine albumin-to-creatinine-ratio: Normal: < 2.5 mg/mmol (M), <3.5 mg/mmol (F) Microalbuminuria: 2.5 - 29 (M), 3.5 - 29 (F)	LTAT: 3 hours	
6.	Alkaline Phosphatase (ALP)	Chem. Path	Heparinised tube	Blood	5 ml	Daily	Males Age 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 Adults : 40 – 129 U/L Females Age 0-14 days : 83-248 U/L 15 days - < 1 year : 122-469 U/L 1-< 10 years : 142-335 U/L 10-< 13 years : 129-417 U/L 13-< 15 years : 57-254 U/L 15-< 17 years : 50-117 U/L 17-< 19 years : 45-87 U/L Female : 35 - 104 U/L	LTAT: 3 hours	
7.	Alpha Feto Protein (AFP)	Chem. Path	Heparinised tube/ Plain tube	Blood	5ml	Daily	<5.8 IU/mL	LTAT: 1 working day	Request by Specialist only
8.	Amikacin	Chem. Path	Plain tube (without gel)	Blood	5ml	Mon-Fri	Refer to individual result report for interpretation and comment	LTAT: 3 hours	TDM request form
9.	Ammonia	Chem. Path	K ₂ EDTA (send in ice)	Blood	5ml	Daily	Male: 16 - 60 umol/L Female: 11 – 51 umol/L	Urgent LTAT: 1 hour	Refer to special procedure
10.	Amphetamine Type Stimulants (Screening)	Chem. Path	Universal Container	Urine	30ml	Daily		LTAT: 1 working day	
11.	Amylase / Diastase	Chem. Path	Heparinised tube /Universal container	Blood / Random Urine	Blood 5mL/ Random Urine 50 mL	Daily	Serum / Plasma: 28 – 100 U/L (male & female) Urine Male: 16-491 U/L Female: 21-447 U/L	Urgent LTAT: 1 hour	
12.	Anti-Nuclear Antibody (ANA)	Microbiology (Serology)	Plain tube	Blood 5mL	5 ml	Once a week		7 working days	
13.	Anti-Streptolysin O titre	Microbiology (Serology)	Plain tube	Blood 5m	5 ml	Daily		1 working day	

14.	Anti-thyroglobulin antibody	Chem. Path	Plain tube	Blood	5 ml	Mon-Fri	Anti-Thyroglobulin positive >115 Anti-Thyroglobulin negative < 115	LTAT: 1 working day	Request by Specialist only
15.	APTT	Routine Hematology	Sodium Citrate	Blood	2 ml for paediatric or 3 ml for adult	Daily	25.1 – 36.5 sec	Urgent: 1 hour Non-Urgent: 2 hours	To send sample immediately (within 2 hours) after collection.
16.	Aspartate Transaminase (AST)	Chem. Path	Heparinised tube	Blood	5 ml	Daily	All ages: Males: 10-50 U/L All ages: Females: 10-35 U/L	LTAT: 3 hours	
17.	Beta-HCG	Chem. Path	Heparinised tube/ Plain tube	Blood	5ml	Daily	Female up to 5.3 mIU/L Trimester/Pregnancy week ranges. Male up to 2.6 mIU/L	LTAT: 1 working day Urgent LTAT: 1 hour (Ectopic pregnancy)	Request by Specialist only
18.	Bilirubin: Total, Direct & Indirect	Chem. Path	Heparinised tube	Blood	5ml	Daily	Total Bilirubin: 0-1 day (< 150 umol/L) 1-2 days (< 193 umol/L) 3-6 days (< 217 umol/L) 1-2 months (< 17 umol/L) 1month - 1 year (<17 umol/L) > 1 year (< 21 umol/l) Direct Bilirubin: 0- 1 month : 0 - 9 umol/L 1 month - adults: < 3.4 umol/L Indirect Bilirubin: All ages :0 - 16 umol/l	LTAT: 3 hours Urgent LTAT: 1 hour (SBV neonate)	Total Bilirubin is done as part of LFT
19.	BK Virus Viral Load	Microbiology (Molecular Diagnostic Lab)	EDTA (4tubes)	Plasma	2.5ml/tubes (4 tubes)	Once a week			
20.	Blood culture & sensitivity (aerobic)	Bacteriology	Aerobic sterile blood container	Blood	5 - 10 ml	Daily		No growth: 5 days Growth: 7 days	
21.	Blood culture & sensitivity (anaerobic)	Bacteriology	Anaerobic sterile blood container	Blood	5 - 10 ml	Daily		No growth: 5 days Growth: 9 days	
22.	Blood culture & sensitivity (fungal)	Bacteriology	Aerobic/Mycology Lytic blood culture bottle	Blood	5-10 ml	Daily		3 weeks	
23.	Blood culture & sensitivity (Paediatric)	Bacteriology	Paediatric blood culture bottle	Blood	1-4 ml	Daily		No growth: 5 days Growth: 7 days	
24.	Blood Film Filaria Parasites (BFFP)	Bacteriology	Blood in EDTA container/ Thick blood smear on slide	Blood	3ml	Daily		6 hours	
25.	Blood Film Malaria Parasite (BFMP)	Bacteriology	Blood in EDTA container/ Thick and thin blood smear on slide	Blood	3ml	Daily		6 hours	For reconfirmation of species send to Makmal Vektor, JKN
26.	Blood Gases, Arterial (ABG)	Chem. Path	Heparinised Syringe	Arterial Blood	1 ml	Daily	pH: 7.37 - 7.45 pCO2: 83 - 108 mmHg pO2: 33 - 45 mmHg Bicarb: 21 - 26 mmol/L Base Excess: -2.0-3.0 O2 Saturation: 94-98%	Urgent LTAT: 1 hour	Refer to special procedure
27.	Body fluid C&S	Bacteriology	Sterile container	Body fluid	Up to 10ml	Daily		No growth: 3 days Growth: 5 days	
28.	Body Fluids Biochemistry: Protein, Glucose, LDH	Chem. Path	Universal container	Body Fluids	10 ml	Daily	No validated reference range	LTAT: 1 working day	
29.	Bone marrow aspirate	Special Haematology	EDTA	Bone marrow	NA	Office hours only	NA	3 working days	1. Please call special haematology lab for appointment 2. Request form to be countersigned by Clinical Haematologist.
30.	Complement 3 (C3)	Chem. Path	Heparinised tube/ Plain tube	Blood	5 ml	Daily	0.9 – 1.8 g/L	LTAT: 3 hours	
31.	Complement 4 (C4)	Chem. Path	Heparinised tube/ Plain tube	Blood	5 ml	Daily	0.1- 0.4 g/L	LTAT: 3 hours	

32.	CA 19-9	Chem. Path	Heparinised tube/ Plain tube	Blood	5 ml	Daily	< 39 U/ml	LTAT: 1 working day	Request by Specialist only
33.	CA 125	Chem. Path	Heparinised tube	Blood	5 ml	Daily	< 35 U/L	LTAT: 1 working day	Request by Specialist only
34.	Calcium (Ca)	Chem. Path	Heparinised tube / 24 hrs urine container	Blood/Urine	Blood:5 ml / 24 hrs urine	Daily	Plasma: 0-10 days: 1.9 -2.6 11 -31 days: 2.25-2.75 1 month-2 years: 2.25-2.75 3 yrs -12 yrs: 2.2 -2.7 13 yrs -18 yrs: 2.1 -2.55 19 yrs-60 yrs: 2.15 -2.5 61 yrs-90 yrs: 2.2 -2.55 Urine 2.5-7.5 mmol/24 h	LTAT: 3 hours LTAT: 1 working day	Refer to special collection procedure
35.	Cannabinoids (screening)	Chem Path	Universal Container	Urine	30 ml	Daily		LTAT: 1 working day	Only for clinical and non-medico legal case
36.	CD4/CD8	Special Haematology	EDTA	Blood	2.0 ml	Mon-Thurs	CD3% : 55 – 80% CD3# : 830 – 2240 cell/µL CD4% : 24 – 48% CD4# : 360 - 1280 cell/µL CD8% : 15 – 38% CD8# : 270-925 cell/µL CD4/CD8 ratio : 0.5 – 2.4	5 working days	Request by ID or Family Medicine Specialist only
37.	Carbamazepine	Chem. Path	Plain tube	Blood	5.0 ml	Mon-Fri	Refer to individual result report for interpretation and comment	LTAT : 3 hours	TDM request form
38.	CEA (Carcino Embryonic Antigen)	Chem. Path	Heparinised tube/Plain tube	Blood	5 ml	Daily	< 5.0 ug/L	LTAT: 1 working day	Request by Specialist only
39.	Chlamydia trachomatis PCR	Microbiology (Serology)	Sterile Container for Urine Specimen; Collection kit for Endocervical and Vaginal Swab	Urine Endocervical Swab; Vaginal Swab	15-20 mL Urine	Daily		3 working days	Collect sample collection kit from the lab.
40.	Chloride (Cl)	Chem. Path	Heparinised tube / Universal container / 24 hrs urine container	Blood/Urine	Blood: 3 ml Random Urine: 50 ml	Daily	Serum / Plasma: 98 - 107 mmol/l, Urine: 110-250 mmol/24hr	LTAT:3 hours	24 hrs urine collection: Refer to special collection procedure
41.	Cholesterol (Chol)	Chem. Path	Heparinised tube	Blood	5 ml	Daily	Desirable: <5.2 mmol/l Borderline: 5.2- 6.2mmol/L High > 6.2 mmol/L	LTAT: 3 hours	Done as part of Fasting Lipid Profile
42.	Cholinesterase (CHE)	Chem. Path	Heparinised tube/ Plain tube	Blood	5 ml	Daily	Male: 5320 – 12920 IU/L Female: 4260 – 11250 IU/L	LTAT: 3 hours	
43.	Clostridium difficile toxin	Bacteriology	Sterile container	Stool	3 ml	Daily		2 hours	Relevant clinical history required
44.	Cryptococcus Antigen	Bacteriology	Sterile container	CSF	CSF 1 ml	Upon Request		1 hour	
45.	CSF Biochemistry: Glucose Protein Chloride Albumin	Chem. Path	Universal Container	CSF	5ml	Daily	Protein: Premature : 0.15-1.3 g/L Fullterm newborn <1 month : 0.40 - 1.2 g/L General : 0.20 - 0.80g/L : 0.15-0.40g/L Lumbar fluid Globulin : 0.15-0.45g/L : NIL	Urgent LTAT: 1 hour	Calculation of CSF/Serum Albumin index requires paired serum albumin sample (taken within 2 hours of CSF sampling)

							Glucose : 2.5-4.5mmol/l Chloride : 120-130 mmol/l		
46.	CSF for Blast	Special Haematology	Sterile urine container	CSF	As collected	Office hours only	NA	3 working days	Fresh samples to be sent before 3.00 pm.
47.	CSF for C&S	Bacteriology	Sterile container	CSF	3 ml	Daily		No growth: 3 days Growth: 5 days	
48.	Culture & Sensitivity for Bordetella pertussis	Bacteriology	Sterile container	Nasopharyngeal Aspirate (NPA)	NA	Daily		No growth: 3 days Growth: 5 days	Please contact Lab for further information.
49.	Culture & Sensitivity for Ear Discharge	Bacteriology	Amies Transport Medium/sterile container	Ear discharge/swab	NA	Daily		No growth: 3 days Growth: 5 days	
50.	Culture & Sensitivity for Eye	Bacteriology	Amies Transport Medium/sterile container	Eye swab	NA	Daily		No growth: 3 days Growth: 5 days	
51.	Culture & Sensitivity for Gonococcus	Bacteriology	Amies transport medium with Charcoal	Urethral swab/Endocervical	NA	Daily		No growth: 3 days Growth: 5 days	
52.	Culture & Sensitivity for Pus/Swab (aerobe/anaerobe)	Bacteriology	Amies Transport Medium sterile container	Pus aspirates/wound swab	NA	Daily		No growth: 3 days Growth: 5 days	
53.	Culture & Sensitivity for Respiratory	Bacteriology	Sterile container	Sputum/tracheal aspirate/ BAL	NA	Daily		No growth: 3 days Growth: 5 days	
54.	Cyclosporine	Chem. Path	EDTA tube	Blood	3 ml	Mon-Fri	Refer to individual result form for interpretation and comment	LTAT: 3 hours	TDM request form
55.	Cytology specimens i) Pap Smear ii) Non gynae smear	Cytology	Slide / Universal container	Smear / fluids	Not Applicable	Working days		Pap smear- Refer to HPP OUTSOURCE TEST LIST for special form	
56.	Cytomegalovirus (CMV) Antibody (IgG, IgM)	Microbiology (Serology)	Plain tube	Blood	3-5 ml	Daily		1 working day	
57.	Cytomegalovirus Viral Load	Microbiology (Molecular Diagnostic Lab)	EDTA (4 tubes)	Plasma	2/5ml/tube (4 tubes)	Once a week			
58.	D-dimer Quantitative Assay	Routine Haematology	Sodium Citrate	Blood	2ml (paediatric) or 3ml (adult)	Daily	<0.5µg/mL FEU	2 hours	
59.	Dengue IgM, IgG ELISA	Microbiology (Serology)	Plain tube	Blood	5 ml	Once a week		7 working days	
60.	Dengue Rapid (NS1Ag, IgM, IgG)	Microbiology (Serology)	Plain tube	Blood	5 ml	Daily		1 hour	
61.	Digoxin	Chem. Path	Heparinised tube	Blood	5 ml	Mon-Fri	Refer to individual result form for interpretation and comment	LTAT: 3 hours	TDM request form

62.	ds-DNA	Microbiology (Serology)	Plain tube	Blood	5 ml	Once a week		7 working days																
63.	EBV IgM & IgG	Microbiology (Serology)	Plain tube	Blood	5 ml	Once a week		IgM: 7 working days IgG: 14 working days																
64.	Efficiency testing of autoclave (Biological indicator)	Bacteriology	Biological indicator tube	Biological indicator	NA	Daily		1 day																
65.	Environmental samples	Bacteriology	NA	Air sample collected on culture plate	NA	Upon request		No growth: 2 days Growth: 7 days	Request by ICN or special circumstances only (e.g. Outbreak)															
66.	Epstein Barr Virus Viral Load	Microbiology (Molecular Diagnostic Lab)	EDTA (4 tubes)	Plasma	2.5ml/tube (4 tubes)	Once a week																		
67.	Erythrocyte Sediment Rate (ESR)	Routine Haematology	Monosed ESR vacuum test tube	Blood	1.28 ml	Daily	<table border="1"> <thead> <tr> <th>Age</th> <th>Male (mm/hr)</th> <th>Female (mm/hr)</th> </tr> </thead> <tbody> <tr> <td>17-50</td> <td>10 or <</td> <td>12 or <</td> </tr> <tr> <td>51-60</td> <td>12 or <</td> <td>19 or <</td> </tr> <tr> <td>61-70</td> <td>14 or <</td> <td>20 or <</td> </tr> <tr> <td>>70</td> <td>30 or <</td> <td>35 or <</td> </tr> </tbody> </table> <p>* If no age stated: 0-35mm/hr</p>	Age	Male (mm/hr)	Female (mm/hr)	17-50	10 or <	12 or <	51-60	12 or <	19 or <	61-70	14 or <	20 or <	>70	30 or <	35 or <	2 hours	
Age	Male (mm/hr)	Female (mm/hr)																						
17-50	10 or <	12 or <																						
51-60	12 or <	19 or <																						
61-70	14 or <	20 or <																						
>70	30 or <	35 or <																						
68.	Estradiol (E2)	Chem. Path	Heparinised tube/ Plain tube	Blood	3 ml	Mon-Fri	Male: 28 - 156 pmol/L Female: Follicular:46 – 607 pmol/L Ovulation: 315 - 1828 pmol/L Luteal: 161 - 774 pmol/ Postmenopausal: <18.4 – 201 pmol/L	LTAT: 1 working day	Request by specialist only															
69.	Extractable Nuclear antigen (ENA) panel	Microbiology (Serology)	Plain tube	Blood	5 ml	Once a week		7 working days																
70.	Factor Assay (FVIII, FIX)	Routine Haematology	Sodium Citrate	Blood	2ml (paediatric) or 3ml (adult)	Office hours only	FVIII: 50.0 – 150.0 IU/dL FIX: 65.0 – 150.0 IU/dL	Urgent: 24 hours Non-urgent: 1 week	Urgent request - please consult Haematopathologist in charge.															
71.	Ferritin	Chem. Path	Heparinised tube/ Plain tube	Blood	5 ml	Daily	Male: 30 – 400 ug/L Female: 13 - 150 ug/L	LTAT: 1 working day	Request by specialist only															
72.	Fibrinogen	Routine Haematology	Sodium Citrate	Blood	2ml (paediatric) or 3ml (adult)	Daily	238 – 498 mg/dL	Urgent: 1 hour Non-urgent: 2 hours																
73.	Fine needle aspiration cytology (FNAC)	Cytology	Slide	Smear	Not Applicable	By Appointment		Please refer to the Cytopathology Customer Charter.																
74.	Flu A/Flu B	Microbiology (Molecular Diagnostic Lab)	VTM	OPS, NPS	5 ml	Daily		3 working days																
75.	Folate	Chem. Path	Heparinised tube/ Plain Tube	Blood	5ml	Mon-Friday	Male: 10.2 – 73.0 nmol/L Female: 10.9 – 84.5 nmol/L	LTAT: 1 working day	Request by specialist only															
76.	Follicle Stimulating Hormone (FSH)	Chem. Path	Heparinised tube	Blood	5 ml	Daily	Male: 1.5 – 12.4 mIU/L Female: Follicular: 3.5 – 12.5 mIU/L Ovulation: 4.7 – 21.5 mIU/L	LTAT: 1 working day	Request by Specialist only															

							Luteal: 1.7-7.7 mIU/L Post menopause: 25.8 - 134.8 mIU/L		
77.	Free Light Chain	Chem. Path	Plain tube	Blood	5 ml	Batches	Refer to individual result form for interpretation and comment	10 working days	Request by Specialist only
78.	Frozen Section	Histopathology	Universal container	Tissue	Not applicable	By Appointment		≤ 45 mins per section	TAT of formalin-fixed paraffin embedded report is 1 month.
79.	Full Blood Count (FBC)	Routine Haematology	EDTA	Blood	2.0 ml	Daily	Vary according to age and sex		
80.	Full Blood Picture (FBP)	Routine Haematology	EDTA	Blood	2.0 ml	Office hour only	NA	Urgent: 0-3 working days Non-urgent: 7 working days	Urgent/after office hour request - please consult MO/Haematopathologist in charge.
81.	G6PD Screening	Routine Haematology	Filter paper	Dried Blood Spot	NA	Daily	NA	24 hours	
82.	Gamma -Glutamyl Transferase (GGT)	Chem. Path	Heparinised tube	Blood	5 ml	Daily	Male: < 60 U/L Female: < 40 U/L	LTAT: 3 hours	
83.	Genital specimen for Culture & sensitivity	Bacteriology	Amies transport medium	HVS/ urethral swab/ endocervical	NA	Daily		No growth: 3 days Growth: 5 days	
84.	Gentamicin	Chem. Path	Plain tube (without gel)	Blood	5 ml	Mon-Fri	Refer to individual result form for interpretation and comment	LTAT: 3 hours	TDM request form
85.	Glucose (Glu): Fasting Blood Glucose (FBG) Random Blood Glucose (RBG)	Chem. Path	Fluoride Tube	Blood	5 ml	Daily	Refer to Blood Glucose test	LTAT: 3 hours	Glucose Tolerance Test (GTT): Refer to special procedure
86.	Hb Analysis	Special Haematology	EDTA tube	Blood	2.0 ml	Office hours only	CE: Hb A : 96.7-97.8% Hb A ₂ : 2.2 – 3.2% Hb F : <1.0% HPLC Hb A ₂ : 2.3 – 3.3% Hb F : <1.0%	Urgent: 2 weeks Semi-urgent: 4 weeks Non-urgent: 6 weeks	Please record the index details (for family screening cases)
87.	HbA1c	Chem. Path	EDTA tube	Blood	5 ml	Mon-Fri	4.0 - 6.0 % (Normal), < 6.5 % (Good Control) 7.0 - 9.0 % (Fair Control) > 9.0 % (Action suggested)	LTAT: 3 working days	
88.	HDL-Cholesterol	Chem. Path	Heparinised tube	Blood	5 ml	Daily	>1.0 Negative factor <1.0 Major risk factor	LTAT: 3 hours	
89.	Hemosiderin, Urine	Special Haematology	Universal Container	Urine	10.0 ml	Office hours only	NA	3 working days	
90.	Hepatitis Be Antigen & Antibody (HBeAg & Ab)	Microbiology (Serology)	Plain tube	Blood	3.5 ml	Daily		1 working day	
91.	Hepatitis B surface Antigen & Antibody (HBsAg & Anti-HBs)	Microbiology (Serology)	Plain tube	Blood	3.5 ml	Daily		1 working day	

92.	Hepatitis B core Antibody (Anti HBcore)	Microbiology (Serology)	Plain tube	Blood	3.5 ml	Daily		1 working day	
93.	Hepatitis B Viral Load	Microbiology (Molecular Diagnostic Lab)	4 EDTA tube/plain tube	Blood/plasma	2.5 ml each tube	By batch		14 working days	
94.	Hepatitis C Antibody (Anti-HCV)	Microbiology (Serology)	Plain tube	Blood	3.5 ml	Daily		1 working day	
95.	Hepatitis C Viral Load	Microbiology (Molecular Diagnostic Lab)	4 EDTA tube/plain tube	Blood/plasma	2.5 ml each tube	By batch		14 working days	
96.	Histopathology specimens i) Small biopsies ii) Big specimens iii) Bone (decalcification)	Histopathology	10% Formalin	Tissue	Not Applicable	Daily		Please refer to the Histopathology Customer Charter.	
97.	HIV (Human Immunodeficiency Virus) Antibody (HIV Ag/AB Combo)	Microbiology (Serology)	Plain tube	Blood	3.5 ml	Daily		1 working day	
98.	HIV-1 Viral load	Microbiology (Molecular Diagnostic Lab)	4 EDTA tube	Blood	2 ml each tube	By batch		14 working days	
99.	HSV IgM & IgG	Microbiology (Serology)	Plain tube	Blood	5 ml	Once a week		IgM: 7 working days IgG: 14 working days	
100.	Immuno-fluorescence for skin and renal biopsies	Histo-pathology	Phosphate Buffered Saline	Tissue	Not Applicable	Batch		1 month	
101.	Immunoglobulin Level - Ig G, A, M	Unit Patologi Kimia, Hospital Pulau Pinang	Plain tube, Paediatric tube	Serum	2.0-3.0 ml (adult), 0.5-1.0 ml (paed)	Daily	IgA: 0.845-4.990 g/L IgG: 6.10-16.16 g/L IgM: 0.35-2.42 g/L	LTAT: 7 working days	
102.	Immuno-histochemistry (tissue)	Histo-pathology	10% Formalin or Fresh	Tissue Block, Unstained Slide	Not Applicable	Daily		1 month	
103.	Immuno-phenotyping	Special Haematology	EDTA	BMA/ Peripheral Blood	2-3ml	Office hour only	NA	3 working days	1. Please call special haematology lab for appointment. 2. Request form to be countersigned by Clinical Haematologist.
104.	Inhibitor Assay	Routine Haematology	Sodium Citrate	Blood	2ml (paediatric) or 3ml (adult) – 4 tubes	Office hours only	NA	3 working days	Urgent/after office hour request - please consult Haemato-pathologist in charge.
105.	Inorganic Phosphate (PO4)	Chem. Path	Heparinised tube / Universal container / 24 hrs urine container	Blood/ Random Urine/ 24 hrs Urine	Blood 5 ml, Random urine 50ml, 24 hr urine	Daily	Serum / Plasma: 0.10 - 6.46 mmol/l 24 hrs Urine 13-42 mmol/day	LTAT: 3 hours LTAT: 1 working day	Volume 24-hour urine ≥500ml, except for ESRD and Paediatric case
106.	Parathyroid Hormone (PTH)	Chem. Path	EDTA tube (send in ice)	Blood	5ml	Mon-Fri	14.9 -56.9 pg/mL	LTAT: 1 working day	Request by Specialist only
107.	Iron (Fe)	Chem. Path	Heparinised tube/ plain tube	Blood	5 ml	Daily	Male 11 - 28 umol/l Female 6.6 - 26 umol/L	LTAT: 1 working day	Request by Specialist only

108.	Kleihauer Test	Special Haematology	EDTA	Blood	2.0 ml	Office hours only	NA	3 working days	
109.	Lactate	Chem. Path	Sodium Fluoride (In ice)	Blood/CSF	3 ml	Daily	Plasma: 0.5 - 2.2 mmol/l	Urgent LTAT: 1 hour	Refer to special procedure
110.	Lactate Dehydrogenase (LDH)	Chem. Path	Heparinised tube	Blood	5 ml	Daily	<250 U/L	LTAT: 3 hours	
111.	LAP (Leukocyte Alkaline Phosphatase) Score	Haematology	glass slides	Blood	2-3 slides	By appointment	15 - 100 score		
112.	Leptospira Rapid Test	Microbiology (Serology)	Plain tube	Blood	5 ml	Daily		1 hour	
113.	LDL-Cholesterol (Calculated)	Chem. Path	Heparinised tube	Blood	5 ml	Daily	3.3-4.9 mmol <3.3 low risk >4.9 high risk	LTAT: 3 hours	
114.	Lithium	Chem Path	Plain tube (without gel)	Blood	5ml	Mon-Fri	Refer to individual result form for interpretation and comment	LTAT: 3 hours	TDM request form
115.	Lupus Anticoagulant	Routine Haematology	Sodium Citrate	Blood	2ml (paediatric) or 3ml (adult)	Office hours only	NA	1 week	
116.	Luteinizing Hormone (LH)	Chem. Path	Heparinised tube/ Plain tube	Blood	5 ml	Daily	Male: 1.7 – 8.6 mIU/L Female: Follicular: 2.4 – 12.6 mIU/ Ovulation: 14.0 – 95.6 mIU/L Luteal: 1.0 – 11.4 mIU/L Post menopause: 7.7 - 58.5 mIU/L	LTAT: 1 working day	Request by specialist only
117.	Magnesium (Mg)	Chem. Path	Heparinised tube / 24 hrs urine container	Blood/ Urine	Blood:5 ml 24 hrs urine	Daily	Serum / Plasma: 0.66 – 0.99 mmol/l Urine 24 hrs: 3.0 - 5.0 mmol/day	LTAT: 3 hours	24 hrs urine collection: Refer to special procedure
118.	Meningitis Panel	Microbiology (Molecular Diagnostic Lab)	Sterile container	CSF	min. 2ml	Daily		1 working day	
119.	MersCoV	Microbiology (Molecular Diagnostic Lab)	VTM	OPS, NPS	5 ml	Daily		2 days	
120.	Methotrexate	Chem. Path	Plain tube (without gel)	Blood	5ml	Mon-Fri	Refer to individual result form for interpretation and comment	LTAT: 3 hours	TDM request form
121.	Minimal Residual Disease (MRD)	Special Haematology	EDTA	Bone Marrow	0.5-1.0ml	Daily	NA	7 working days	1.Please call special haematology lab for appointment. 2. Request form to be countersigned by Clinical Haematologist
122.	Mixing Test	Routine Haematology	EDTA	Blood	2ml (paediatric) or 3ml (adult) – 2 tubes	Office hours only	NA	24 hours	Urgent/after office hour request - please consult Haemato-pathologist in charge.
123.	Molecular Quantitation BCR::ABL1 (p210)	Routine Haematology	EDTA	Peripheral blood	2ml x 3	Tuesday and Thursday	NA	14 working days	Please call special haematology lab for appointment.

124.	Morphine/Opiate (Screening)	Chem. Path	Universal container	Urine	30ml	Daily		LTAT: 1 working day	
125.	Mycoplasma pneumoniae Antibody	Microbiology (Serology)	Plain tube	Blood	5 ml	Once a Week		7 working days	
126.	Osmolality	Chem. Path	Plain/Heparinised tube / Universal container	Blood / Urine	Blood 3 ml, Urine 5 ml	Daily	Serum: 270 - 290 mOsm/kg Urine: 300 - 900 mOsm/kg	LTAT: 1 day	
127.	Paraquat	Chem. Path	Universal Container	Urine	50 ml	Daily		LTAT: 3 hours	
128.	Peritoneal Fluid (PD) for Differential Counts	Special Haematology	Sterile Urine Container	Peritoneal Dialysis Fluid	2ml	Office hours only	NA	3 working days	
129.	Pernasal swab for Bordetella pertussis	Bacteriology	Flexible wire and Bordet Gengou agar media.	Swab	NA	Daily		No growth: 3 days Growth: 5 days	Please contact Lab for further information.
130.	Phenobarbital	Chem. Path	Plain tube (without gel)	Blood	5 ml	Mon-Fri	Refer to individual result form for interpretation and comment	LTAT: 3 hours	TDM request form
131.	Phenytoin	Chem. Path	Plain tube (without gel)	Blood	5 ml	Mon-Fri	Refer to individual result form for interpretation and comment	LTAT: 3 hours	TDM request form
132.	Potassium (K)	Chem. Path	Heparinised tube /Universal container /24 hrs urine container	Blood / Urine	Blood 5 ml, Random urine 5 ml, 24 hr urine	Daily	Plasma: 3.4 - 4.5 mmol/L, Serum: 3.5-5.1 mmol/L Random urine: 40 - 120 mmol/L Urine 24hrs: 25 - 125 mmol/d	LTAT: 3 hours	24hr urine collection: Refer to special collection procedure
133.	Procalcitonin	Chem. Path	Heparinised tube /Plain tube	Blood	5 ml	Daily	<0.05 ng/ml	LTAT: 1 day	
134.	Progesterone	Chem. Path	Heparinised /Plain tube	Blood	5 ml	Mon-Fri	Male: <0.16 – 0.47 nmol/L Female Follicular: <0.16 – 0.62 nmol/L Ovulation: 0.18-13.20 nmol/L Luteal: 13.10-46.30 nmol/L Post menopause: <0.16-0.40 nmol/L	LTAT: 1 working day	Request by specialist only
135.	Prolactin (Pro)	Chem. Path	Heparinised /Plain tube	Blood	5 ml	Daily	Male: 86 - 324 mIU/L Female: 102 - 496 mIU/L	LTAT: 1 working day	Request by specialist only
136.	Prostate Specific Antigen (PSA)	Chem. Path	Heparinised /Plain tube	Blood	5 ml	Daily	< 4.0 ug/L	LTAT: 1 working day	Request by specialist only
137.	Protein Creatinine Index	Chem. Path	Universal container	Urine	5 ml	Daily	< 0.015 mg/mmol	LTAT: 1 working day	
138.	Protein Electrophoresis (Serum)	Chem. Path	Plain tube	Blood / Urine	Blood 5 ml	Batches	Refer to individual result form for interpretation and comment	LTAT: 10 working day	Special Chem Path Lab Require by specialist
139.	Prothrombin Time (PT)	Routine Haematology	Sodium Citrate	Blood	2ml (paediatric) or 3ml (adult)	Daily	9.4 – 12.5 sec	Urgent: 2 hours Non-urgent: 4 hours	

140.	Rapid test for Flu A/Flu B/ RSV and Adenovirus	Microbiology (Molecular Diagnostic Lab)	Sterile container	OPS, NPS, TA	NA	Daily		1 working day	
141.	Reducing Sugar	Chem. Path	Universal Container	Urine	10 ml	Daily	NA	LTAT: 1 working day	Only for paediatric
142.	Respiratory Panel	Microbiology (Molecular Diagnostic Lab)	VTM	OPS, NPS	5 ml	Daily		1 working day	
143.	RPR (Syphilis)	Microbiology (Serology)	Plain tube	Blood	5 ml	Daily		1 working day	
144.	Rubella IgG & IgM	Microbiology (Serology)	Plain tube	Blood	5 ml	Daily		1 working day	
145.	SARS-CoV-2	Microbiology (Molecular Diagnostic Lab)	VTM	OPS, NPS	5 ml	Daily		2 days	
146.	Salicylate	Chem. Path	Plain tube (without gel)	Blood	5 ml	Daily	Refer to individual result form for interpretation and comment	Urgent LTAT: 1 hour	TDM request form
147.	Sterility testing	Bacteriology	Sterile container	Pharmaceutical products/EBM	5 ml	Daily		7 days	
148.	Seminal Fluid analysis (SFA)	Cytology	Sterile screw-capped bottle	Semen	>1.0 ml	Once Weekly Thursday			Only By Appointment from the Urology or O&G Department.
149.	Stool for FEME	Bacteriology	Sterile screw cap container	Faeces	Small amount or a size of groundnut	Daily	Normal = Absent	1 hour	Direct Smear Method to screen for ova, cysts, amoeba, worm, trichomonas and giardia lamblia & the nature and consistency of the stool.
150.	Stool for Culture & Sensitivity	Bacteriology	Sterile container/	Stool	Small amount	Daily		No growth: 3 days Growth: 7 days	
151.	Stool for Occult Blood	Chem. Path	Sterile screw cap container	Faeces	Small amount or a size of ground nut	Daily	Normal=Absent / Negative	LTAT: 1 working day	
152.	Stool for Vibrio cholera	Bacteriology	Sterile container/ APW	Stool	3 ml	Daily		No growth: 3 days Growth: 7 days	
153.	Tacrolimus	Chem. Path	EDTA tube	Blood	3 ml	Mon-Fri	Refer to individual result form for interpretation and comment		TDM request form
154.	TB Culture	Microbiology (TB Lab)	Myc F-Lytic bottle/Sterile container	Any specimen	NA	Daily		10 weeks	
155.	TB MDR (GeneXpert)	Microbiology (TB Lab)	Sterile container	Sputum/ Tracheal aspirate/BAL/ Body Fluid	2 ml	Daily		1 working day	For CSF any volume acceptable

156.	Testosterone	Chem. Path	Heparinised /Plain tube	Blood	5 ml	Mon-Fri	Male:8.6-29.0 nmol/L Female:0.30-1.70 nmol/L	LTAT: 1 working day	Request by Specialist only
157.	Tissue for Culture & Sensitivity	Bacteriology	Sterile container	Tissue / Bone	NA	Daily		No growth: 3 days Growth: 5 days	
158.	Theophylline	Chem. Path	Plain tube (without gel)	Blood	5 ml	Mon-Fri	Refer to individual result form for interpretation and comment	LTAT: 3 hours	TDM request form
159.	Throat swab Culture & sensitivity	Bacteriology	Amies Transport medium (Black)	Swab	NA	Daily		No growth: 3 days Growth: 5 days	
160.	Thyroglobulin	Chem. Path	Plain tube	Blood	5 ml	Mon-Fri	Athyrotic: <0.1 ng/mL Intact thyroid: 3.5-77 ng/mL	LTAT: 1 working day	Request by Specialist only
161.	Thyroglobulin antibody	Chem. Path	Plain tube	Blood	5 ml	Mon-Fri	<115 IU/mL	LTAT: 1 working day	Request by Specialist only
162.	Thyroid Stimulating Hormone (TSH)	Chem. Path	Heparinised/ Plain tube	Blood	5 ml	Daily	Cord blood: <20 mIU/L Borderline 20-60 mIU/L neonate 4-6 day: <6.00 mIU/L neonate 7-30 day: 0.72-11.00 mIU/L Adults: 0.27 – 4.20 mIU/L	LTAT: 1 working day	Request by Specialist only
163.	Thyroid Peroxidase Antibody	Chem. Path	Plain tube	Blood	5 ml	Mon-Fri	<35 IU/mL	LTAT: 1 working day	Request by Specialist only
164.	Thyroxine, Free (Free T4)	Chem. Path	Heparinised/ Plain tube	Blood	5ml	Daily	Cord blood: Normal <15 pmol/L Neonate 4-6 days: 13-28 pmol/L Neonate 7-30 day:12-28 pmol/L 12 yrs- 20 yrs: 13-21pmol/L Adult: 12-22 pmol/L	LTAT: 1 working day	Request by Specialist only
165.	Toxoplasma Antibody (IgG, IgM)	Microbiology (Serology)	Plain tube	Blood	5 ml	Daily		IgM: 1 working day IgG: 2 working day	
166.	Transferrin	Chem. Path	Heparinised/Plain tube	Blood	5 ml	Daily	2.00-3.60 g/L	LTAT: 1 working day	
167.	Treponema pallidum particle agglutination (TPPA)	Microbiology (Serology)	Plain tube	Blood	5 ml	Once a week		7 working days	
168.	Triglyceride	Chem. Path	Heparinised tube	Blood	5 ml	Daily	<1.7 mol/L	LTAT: 3 hours	Fasting sample. Consuming no food or liquids other than water, for nine to 12 hours before the test
169.	Triiodothyronine, Free (Free T3)	Chem. Path	Heparinised tube/ Plain tube	Blood	5 ml	Daily	3.1 – 6.8 pmol/L	LTAT: 1 working day	Request by Specialist only
170.	Trephine biopsy	Histo-pathology & Haematology	10% Formalin	Trephine biopsy	1-3 cm	By Appointment		1 month	
171.	Troponin T, high sensitivity	Chem. Path	Heparinised tube	Blood	5 ml	Daily	<14 ng/mL	Urgent LTAT: 1 hour	No sharing tests allowed in tube and request form. If sharing tube, the stipulated TAT may not be achieved.

172.	Urea	Chem. Path	Heparinised tube /Universal container /24 hrs urine container	Blood/ Urine	Blood:5 ml 50 ml random / 24hr urine	Daily	Serum/plasma: 2.76-8.07 mmol/L Urine 24 hrs: 428-714 mmol/24 hours	LTAT: 3 hours	Done as part of Renal Profile/ BUSE. 24hr urine collection: Refer to special collection procedure
173.	Uric acid	Chem. Path	Heparinised tube/ 24hrs Urine Container	Blood/ Urine	3 ml	Daily	Serum / Plasma: Male : 202.3 – 416.5 umol/l Female : 142.8 – 339.2 umol/L Urine : 1200 -5900 umol/day	LTAT: 3 hours	24hr urine collection: Refer to special collection procedure
174.	Urinalysis (Qualitative)	Chem. Path	Sterile screwed capped container	Urine	Adult: 5 ml Paed:1 - 5 ml	Daily	SG: 1.010 - 1.035 pH: 5.5 - 7.0 Leukocytes: Negative Nitrite: Negative Protein: Negative Glucose: Negative Ketone: Negative Urobilinogen: <17 umol/L Bilirubin: Negative Color: Yellow	LTAT: 3 hours	
175.	Urine for culture & sensitivity	Bacteriology	Sterile urine container	Urine	Adult: 25 ml Paed: 1 - 5 ml	Daily		No growth: 3 days Growth: 5 days	
176.	Urine for microscopy	Clinical Lab/ Chem. Path	Universal container	Urine	5 ml	Daily	RBC: 0- 5 N/uL WBC: 0-5 N/uL Bacteria/Mucus/crystal/Epithelia cells/pathological cast-not detected	LTAT: 3 hours	
177.	Urine HCG	Chem. Path	Universal container	Urine	5 ml	Daily		LTAT: 3 hours	
178.	Valproic Acid	Chem. Path	Plain tube (without gel)	Blood	5 ml	Mon-Fri	Refer to individual result form for interpretation and comment	LTAT: 3 hours	TDM request form
179.	Vancomycin	Chem. Path	Plain tube (without gel)	Blood	5 ml	Mon-Fri	Refer to individual result form for interpretation and comment	LTAT: 3 hours	TDM request form
180.	Vitamin D	Chem. Path	Heparinised tube / Plain tube	Blood	5ml	Daily	75-250 nmol/L	LTAT: 1 working day	Request by specialist only
181.	Vitamin B12 level	Chem. Path	Heparinised tube/Plain tube	Blood	5ml	Mon-Fri	145-569 pmol/L	LTAT: 1 working day	Request by specialist only
182.	vWF Antigen	Routine Haematology	Sodium Citrate	Blood	2ml (paediatric) or 3ml (adult)	Office hours only	42 – 158 %	1 week	Urgent/after office hour request - please consult Haemato-pathologist in charge.
183.	vWF: Rcof	Routine Haematology	Sodium Citrate	Blood	2ml (paediatric) or 3ml (adult)	Office hours only	48 – 240 %	1 week	Urgent/after office hour request - please consult Haemato-pathologist in charge.

APPENDIX II

PRE-ANALYTICAL FACTORS AFFECTING REALIBILITY TEST RESULTS

Medical Microbiology				
No	Pre-analytical factors	Tests	Effects on results	Notes
1	Poor sampling (Wrong site of specimen collection)	Culture and sensitivity tests	Poor yield of pathogens	-
2	Delay in transportation	Culture and sensitivity tests	Poor yield of pathogens	-
3	Insufficient volume of specimen	Serology tests, Virology tests, Culture and Sensivity	Poor yield of pathogens	-
4	Sample sent without ice pack	Virology Tests	Poor yield of pathogens	-
5	Mislabelling of specimen	All microbiology tests	Rejection	-
6	Wrong container	All microbiology tests	Rejection	-
7	No doctor's signature of request form	Serology tests	Rejection	-
Haematology				
No	Pre-analytical factors	Tests	Effects on results	Notes
Sample collection				
1	Difficult phlebotomy/clotted sample	PT/APTT	Prolonged	Loss of coagulation factors to form clot
		FBC	Inaccurate platelet count (falsely reduced)	Consumption of platelets to form clot
2	Hemolysis due to difficult phlebotomy or vigorous mixing of sample	PT/APTT	Inaccurate result (shortened or prolonged depends on degree of hemolysis)	-
		FBC	Decrease in RBC and HCT	RBCs lyse and become fragments which can be miscaptured as platelet instead of RBC. HCT and MCH are calculated from formula using RBC.
	Increase in MCH and platelet			
3	Inadequate sample volume or high hematocrit sample	PT/APTT	Prolonged	Excess anticoagulant to plasma ratio
4	Prolonged tourniquet use	PT/APTT	Shortened	Falsely elevates vWF, FVIII due to venous stasis
5	Uncap the tube	PT/APTT	Inaccurate result (shortened or prolonged)	Loss of vacuum can affect the sample volume filled and the anticoagulant to plasma ratio
6	Incorrect container (e.g. EDTA tube)	PT/APTT	Prolonged	Contamination by other anticoagulants (e.g. EDTA prevent clotting)

7	Contamination with heparin	APTT	Prolonged	Heparin prevents blood from clotting
8	Contamination with infusion fluid	FBC	Reduced Hb, WBC, RBC and platelet	Dilutional effect
Sample Transportation				
9	Sample kept in refrigerator	PT/APTT	PT shortened	Activation of Factor VII
10	Delay in sending specimen (>4hours)	PT/APTT	Prolonged	Loss of labile factors (FV, FVIII)
		FBC/Full blood picture	Elevated MCV and HCT Morphological changes of RBC and WBC	-
Chemical Pathology				
No	Pre-analytical factors	Tests	Effects on results	Notes
1	Hemolysis	Potassium, AST, LDH, Ammonia, CK, Folate	Excessive shaking or too small bore needle causes trauma to RBCs, prolonged tourniquet application will cause spuriously raised levels.	-
2	IV drip contamination and wrong order of draw	Glucose, Sodium, Chloride, Potassium, Calcium, ALP	IV infusion contamination may increase the listed analyte levels and possible dilution of other tests.	-
			Avoid decanting/transferring blood from one tube to another to avoid contamination of other tubes with K+ EDTA preservative. This will cause chelation of Ca (low levels) and raised K levels. Follow "Order of Blood Draw" shown in page 21.	-
3	Prolonged tourniquet	Calcium, Lactate, Ca, Mg, Pho	Values possibly increased or decreased	-
4	Overnight sample	K, Pho	Values will be raised	-
5	Icteric sample	Creatinine, Lactate, Triglycerides	Lactate and creatinine measurement may be increased, and TG may be increased or decreased	-
9	High Lipaemic sample	Sodium, LDL-c	Sodium measurement will be falsely decreased due to hyperlipidaemia (Electrolyte Exclusion Effect). Laboratory will use Direct Method (ABG) to measure Sodium level.	-
10	High Protein sample	Sodium, LDL-c	Sodium measurement will be falsely decreased due to hyperproteinaemia (Electrolyte Exclusion Effect). Laboratory will use Direct Method (ABG) to measure Sodium level.	-

11	Hetererophile antibodies, Hook effects, drugs, biotin	Immunoassays eg hormones, tumour markers	If any result discrepancy noted or further enquiry needed, please seek advice from Chemical Pathologist	-
12	Wrong patient tube	All Tests	Cause erroneous results	-
13	Related to Therapeutic Drug Monitoring	Therapeutic Drug Monitoring	Not possible to list all interference in analytes. Advice from Laboratory staff	Ensure pre and post sample labelled is properly and the correct drug test ordered
Histopathology				
No	Pre-analytical factors	Tests	Effects on results	Notes
1	Patients' misidentification	HPE	Slow down the registration process, sample processing in the laboratory as well as the release of results	-
2	Mislabelled of specimen	HPE	Slow down the registration process, sample processing in the laboratory as well as the release of results	-
3	Incomplete clinical information	HPE	Misdiagnosis, missed ancillary testing	-
4	Wrong site of specimen collection	HPE	Misdiagnosis	-
5	Tissue mishandling during sampling (crushing, squeezing, thermal)	HPE	Distorting cellular morphology and inaccurate margin assessment	-
6	Cross-contamination	HPE	Inaccurate diagnosis	Unclean instruments can cause tissue mixing
7	Inadequate sampling	HPE	Incomplete staging, missed pathology	-
8	Delay in fixation	HPE	Poor fixation will affect interpretation	-
9	Delay in transport	HPE	Tissue degradation, unreliable histology/IHC	-
10	Improper fixation	HPE	Poor fixation will affect interpretation	Specimens for routine HPE need be sent in 10% Neutral Buffered Formalin (NBF) solution
				Specimen for Immunofluorescence (IF) stain must be sent fresh in Phosphate Buffered Saline (PBS) solution
				Specimens for frozen sections need be sent fresh without fixative
11	Insufficient fixative volume	HPE	Poor fixation will affect interpretation	Ratio of 10% Neutral Buffered Formalin solution to specimen is 10:1

12	Incorrect size of container	HPE	Poor penetration to the tissue due to insufficient fixative volume	-
13	Container leakage	HPE	Loss of fixative can dry out the specimen	-
Cytopathology				
No	Pre-analytical factors	Tests	Effects on results	Notes
1	Delay in transportation	All Cytological Specimen	Slow down the registration process, sample processing in the laboratory as well as the release of results	-
2	Mislabeling of specimen / form	All Cytological Specimen	Specimens have to be rejected	-
3	Incomplete of patient's or clinician's details on request form (PER-PAT 301 / Borang PS 1/98)	All Cytological Specimen	Specimens have to be rejected / Slow down the registration process, sample processing in the laboratory as well as the release of results	-
4	Incorrect test orders	All Cytological Specimen	Specimens have to be rejected	-
5	Inadequate fixative volume in Liquid-Based Cytology (LBC)	Pap Smear	Delay in sample processing in the laboratory and the release of results	-
6	The stick of the brush is inserted in a Liquid-Based Cytology (LBC) bottle	Pap Smear	May cause damage to the sample processing machine and slow down the sample processing	-
7	Labelling from the clinic covers the mark of the fixative level on Liquid-Based Cytology (LBC) bottle	Pap Smear	Delay in sample processing in the laboratory and the release of results	-
8	Incorrect container	Non-Gynae	Delay in sample processing in the laboratory and the release of results	Laboratory only accept specimen in Sterile Sample Container or Urine Drainage Bag (Not more than 2L)
9	Container leakage	Non-Gynae	Delay in sample processing in the laboratory and the release of results	-
10	No time taken is documented in the request form (PER-PAT 301)	Non-Gynae and Seminal Fluid Analysis	Delay in sample processing in the laboratory and the release of results	Essential for CSF (Within 1 hour), urine (Within 24 hours) and semen (For Seminal Fluid Analysis)
11	Incorrect storage of samples	Seminal Fluid Analysis	Specimens have to be rejected	Specimen for Seminal Fluid Analysis needs to be at body temperature

Appendix III

LIST OF ABBREVIATIONS USED:

ABG	Arterial blood gas
ABT	Autologous for blood transfusion
ACTH	Adrenocorticotropic hormone
AFB	Acid fast bacilli
APA	Antiphospholipid antibodies
APTT	Activated Partial Thrombin Time
ASOT	Anti-Streptolysin O titre
ATS	Amphetamine Type Stimulant
BACTEC TB	Automated TB Culture System
BAL	Bronchoalveolar lavage
BFFP	Blood film for Filaria Parasites
BFMP	Blood film for Malaria Parasites
BMA	Bone marrow aspirates
C & S	Culture and Sensitivity
FBC	Full Blood Count
CIEP	Counter Immunoelectrophoresis
CK-MB	Creatin Kinase, Muscle and Brain
CMV	Cytomegalovirus
CRBSI	Catheter-related bloodstream infection
CRP	C-Reactive Protein
CSF	Cerebrospinal fluid
DIC	Disseminated intra-vascular coagulation
DMD	Diabetes & Metabolic Disorders
DOA	Drug of abuse
D/S	Direct smear
EDTA	Ethylenediaminetetraacetic acid
ELISA	Enzyme-linked immunosorbent assay

ESR	Erythrocyte Sediment Rate
FBC	Full Blood Count
FBG	Fasting Blood Glucose
FBP	Full Blood Picture
FFP	Fresh frozen plasma
FNA	Fine needle aspiration
FNAC	Fine needle aspiration for cytology
GSH	Group, Screen and Hold cases
HAART	Highly Active Anti-Retroviral Therapy
Hb	Haemoglobin
HBsAg	Hepatitis B surface antigen
HCL	Hydrochloric acid
HCV	Hepatitis C virus
HIAA	Hydroxyindoleacetic acid
HIV	Human Immunodeficiency Virus
HKL	Hospital Kuala Lumpur
HLA	Human Leukocyte Antigen
HPE	Histopathological examination
HPP	Hospital Pulau Pinang
HPLC	High Performance Liquid Chromatography
Hrs	Hours
HUKM	Hospital Universiti Kebangsaan Malaysia
HVS	High Vaginal Swab
IAT	Indirect Antiglobulin Test
I.C.	Identity Card
ICT	Immunochromatography test
ICU	Intensive Care Unit
i.e.	"id est", "that is"
IEM	Inborn error of metabolism
IFAT	Immunofluorescence antibody test
IIP	Indirect Immunoperoxidase
IMR	Institute of Medical Research

IP	Immunophenotyping
ITP	Idiopathic/autoimmune thrombocytopenic Purpura
LAP	Leukocyte alkaline phosphatase
LTAT	Laboratory turn around time
MGTT	Modified glucose tolerance test
MH	Maternity Hospital
MLT	Medical Laboratory Technologist
MSBOS	Maximum Surgical Blood Ordering Schedule
NA	Not applicable
NAIT	Neonatal Alloimmune thrombocytopenia
NRIC	New Registration Identity Card
NSI	Needle stick injury
Off. IC	Officer In-charged
OGTT	Oral glucose tolerance test
OPD	Out-Patient Department
PA	Particle agglutination
PAP	Papanicolaou
PAS	Periodic acid-Schiff
PC	Platelet count
PCR	Polymerase chain reaction
PCV	Packed cell volume
PRO	Public Relation Officer
PT	Prothrombin Time
PTP	Post transfusion Purpura
PTT	Partial Thromboplastin time
RBC	Red blood cell
RBG	Random Blood Glucose
Rh	Rhesus
RP	Renal profile
RPR	Rapid plasma reagin
RN	Registration Number
RT	Room temperature

STAT	At once, immediately
SDC	Specialized Diagnostic Centre
SO	Scientific Officer
TAT	Turn-around-time
TB	Tuberculosis
TRBC	Total red blood cell count
TWBC	Total white blood cell count
TWDC	Total white differential count
UPT	Urine pregnancy test
VBG	Venous blood gas
VDRL	Venereal Disease Research Laboratory
VTM	Viral transport medium
WBC	White blood cell

CUSTOMER CHARTERS



CUSTOMER CHARTER
MICROBIOLOGY LABORATORY
DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG

TEST	LTAT
C&S Report (No Growth)	
(i) Urine	2 days
(ii) CSF, Body Fluid, Tracheal Asp, Sputum, Pus, Tips, Swab, Tissue, Bone, Stool, Genital	3 days
(iii) Blood final report	5 days
C&S Report (Growth)	
(i) CSF, Body Fluid, Tracheal Asp, Sputum, Pus, Tips, Tissue, Swab, Bone, Genital Swab, Urine	5 days
(ii) Stool	7 days
(iii) Blood final report Aerobic culture Anaerobic culture	7 days 9 days
CSF Gram Stain & Indian Ink for CSF (preliminary result) CSF Cryptococcal Antigen Detection Test Stool for Ova and Cyst	1 hour
<i>Clostridium difficile</i> Toxin	2 hours
Blood Film Malaria Parasite	4 hours
AFB Direct Smear	1 working day
TB: Culture, TB: Identification & Drug Sensitivity (MKAK)	10 weeks

Fungal Culture	3 weeks
HBsAg, Anti HBs, Anti HBe, HBeAg, Anti HBcore (total antibody), Anti-HCV, HIV Ag/Ab combo, Toxoplasma IgM, CMV IgM, Rapid Plasma Reagin (RPR), Anti Streptolysin O titre (ASOT)	1 working day
Toxoplasma IgG, CMV IgG	2 working days
Dengue IgM & IgG, EBV IgM, HSV IgM, TPPA, <i>Mycoplasma pneumoniae</i> serology, Antinuclear Antibody, Anti dsDNA, ENA	7 working days
EBV IgG, HSV IgG, HIV-1 / HBV / HCV Viral Load	14 working days
<i>Chlamydia trachomatis</i> PCR, Influenza A & B PCR	3 working days
Cryptococcal Antigen Serum-upon request	1 working day
MERS-CoV / SARS-CoV-2 PCR	2 days
Respiratory Viruses Antigen Detection Test	1 working day
Covid-19 RTK, Dengue Combo Rapid Test, Leptospira Rapid Test	1 hour

CUSTOMER CHARTER
CHEMICAL PATHOLOGY LABORATORY
DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG

No.	TEST	LTAT
1	Routine test results	3 hours
2	URGENT test results (except for many/group profiles request)	60 Minutes
3	Endocrine and metabolic tests results	1 working day
4	HbA1C test results	3 working days
5	Serum Protein Electrophoresis dan Serum Free Light Chains results	10 working days

CUSTOMER CHARTER
HISTOPATHOLOGY LABORATORY
DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG

NO.	TEST	LTAT
1	URGENT SPECIMEN (Small specimen which do not require any further investigation such as immunohistochemistry test, histochemistry test, deeper level, regrossing or second opinion.)	3 WORKING DAYS
2	ROUTINE SPECIMEN	1 MONTH
3	FROZEN SECTION SPECIMEN	≤45 MINUTES (FOR EACH SECTION)

NOTE:

- i. LTAT for all of the above will start from the time of the specimen received in Histopathology laboratory until the report validated in the LIS or dispatched as stated in the Histopathology laboratory dispatch book.
- ii. LTAT for Histopathology report is subjected to the number of staff available, further investigation ordered, regrossing, second opinion and total number of cases/workload received.

**CUSTOMER CHARTER
CYTOPATHOLOGY LABORATORY
DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG**

NO.	TEST	LTAT
1	<u>FNAC</u> URGENT NON-URGENT FNAC WITH CELL BLOCK	3 WORKING DAYS 7 WORKING DAYS 15 WORKING DAYS
2	<u>PAP SMEAR</u> URGENT NON-URGENT	7 WORKING DAYS 30 WORKING DAYS
3	<u>NON-GYNAE</u> URGENT NON-URGENT NON-GYNAE WITH CELL BLOCK	3 WORKING DAYS 7 WORKING DAYS 15 WORKING DAYS
4	SEMINAL FLUID ANALYSIS (SFA)	1 WORKING DAY

NOTE:

1. LTAT for all of the above will start from the time of the specimen received in the Cytology laboratory.
2. LTAT for the ABNORMAL smear is subjected to the number of pathologists available.
3. For technical assistance of FNAC in ward / clinic / X-ray (not including the scheduled session in specialist clinics) please contact us at ext. 5650.
4. Seminal Fluid Analysis is only done as scheduled by the Urology Department and Obstetrics & Gynaecology Department.

CUSTOMER CHARTER
ROUTINE HAEMATOLOGY LABORATORY
DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG

NO	TEST	LTAT
1	Full Blood Count (FBC)	Urgent: 45 minutes Non-urgent: 2 hours
2	Slide Review	24 hours
3	Full Blood Picture (FBP)	Urgent: 0-3 working days Non-urgent: 7 working days
4	Coagulation Profile (PT/APTT)	Urgent: 1 hour Non-urgent: 2 hours
5	Fibrinogen (FBG)	
6	Erythrocyte Sedimentation Rate (ESR)	2 hours
7	D-Dimer	2 hours
8	G6PD Screening Test	24 hours

9	Factor Assay (FVIII/FIX)	Urgent: 24 hours Non-urgent: 1 week
10	Mixing Test	24 hours
11	Inhibitor Assay	3 working days
12	Lupus Anticoagulant	1 week
13	Von Willebrand Antigen (vWF:Ag)	1 week
14	Von Willebrand Ristocetin Cofactor (vWF:Rcof)	1 week

CUSTOMER CHARTER
SPECIAL HAEMATOLOGY LABORATORY
DEPARTMENT OF PATHOLOGY
HOSPITAL PULAU PINANG

NO	TEST	LTAT
1	Bone Marrow Aspirate (BMA)	3 working days
2	Immunophenotyping	3 working days
3	Minimal Residual Disease (MRD)	7 working days
4	CD4/CD8	5 working days
5	CSF for Blast Cells	3 working days
6	Kleihauer Test	3 working days
7	Urine for Haemosiderin	3 working days
8	PD Fluids for Eosinophils	3 working days
9	Molecular Quantitation for Major BCR::ABL1 (p210)	14 working days
10	Hb analysis	Urgent: 2 weeks Semi-Urgent: 4 weeks Non-Urgent: 6 weeks

No.	Test	Tube	Request Form	Notes	LTAT
Special Haematology Laboratory					
i.	Bone Marrow Aspirate	-	Per-PAT 301 (A4 Size)	By appointment	3 working days
ii.	Immunophenotyping	1 EDTA Tube	Per-PAT 301 (A4 Size)	By appointment	3 working days
iii.	Minimal Residual Disease (MRD)	1 EDTA tube	Per-PAT 301	By appointment	7 working days
iv.	CD4/CD8	1 EDTA Tube	Per-PAT 301		5 working days
v.	CSF for Blast Cells	Sterile urine container	Per-PAT 301	Sample should arrive in lab latest by 3 pm	3 working days
vi.	Kleihauer test	1 EDTA Tube	Per-PAT 301	-	3 working days
vii.	Urine for Haemosiderin	Sterile urine container	Per-PAT 301	-	3 working days
viii.	PD Fluids for Eosinophils	Sterile urine container	Per-PAT 301	-	3 working days
ix.	Molecular Quantitation Major BCR-ABL1 (p210)	3 peripheral blood in EDTA tube	Per-PAT 301	Clinical history is required. By appointment.	14 working days
x.	Hb Analysis	1 EDTA Tube	Per-PAT 301	Clinical history is required	Urgent : 2 weeks Semi Urgent : 4 weeks Non Urgent: 6 weeks

NOTES