

Laboratory Diagnosis of Cancer

Professor Tamanna Choudhury HOD, Pathology MCWH



References:

- Robbins & Cotran Pathologic Basis of Disease- 9th edition
- IMAGES- Above mentioned book & internet



Laboratory Diagnosis Of Cancer

The diagnosis of patients with neoplastic disease requires a logical and careful application of

- History taking
- Clinical examination
- Radiological imaging, haematological assays and biochemical tests
- Appropriate special tests and investigations.



Laboratory Diagnosis Of Cancer

The ultimate diagnosis of neoplasia requires

- HISTOPATHOLOGICAL ASSESSMENT OR
- A TISSUE DIAGNOSIS.



Laboratory Diagnosis of Cancer

- I. Cytopathology
- II. Histopathology
- **III. Tumour markers**
- **IV. Immunohistochemistry**
- V. Flow Cytometry
- **VI.** Circulating tumour cells
- **VII. Molecular and Cytogenetic diagnostics**



CYTOPATHOLOGY Sampling methods

- Fine Needle Aspiration (FNA)- unguided or image guided
- **Exfoliative cytology- sputum**, urine
- Abrasive cytology cervical smear
- Brushing cytology
- Imprint cytology



Fine Needle Aspiration (FNA)

• The procedure involves aspirating cells and attendant fluid (diagnostic material) with a small-bore needle, followed by cytologic examination of the stained smear





Common organs for FNAC

Palpable lesions of:

- Salivary gland
- Thyroid
- Lymph node
- Breast
- Superficial soft tissue swelling



Fine Needle Aspiration Cytology (FNAC)





FNAC smear



Smear preparation

4/10/2020

Tamanna Choudhury



Fine Needle Aspiration Cytology (FNAC)



Stained smears



Cervical smear



Normal smear

Abnormal smear shows numerous malignant cells with pleomorphic, hyperchromatic nuclei



HISTOPATHOLOGY

- The most important method of diagnosis
- Samples may be obtained by- excisional biopsy, incisional biopsy, core biopsy, punch biopsy, endoscopic biopsy, radical excision etc.



HISTOPATHOLOGY

Proper histopathology diagnosis requires

- Complete clinical data- age, gender, site
- 2. Adequate, representative sample and
- 3. Properly preserved specimen



Medical College for Women & Hospital

DEPARTMENT OF PATHOLOGY

Request For Histopathological Examination

Patient's Name:		Consultant	
Date of Birth:		Medical Officer:	
AgeM/F Married/Single		Name:	
Mother/Father/Spouse's name:		Signature:	
MCWH Reg. No/Non MCWH		Phone:	
Ward/OPDBed No_	Unit		
Name of the specimen:			
Fixative: 10% Formalin A	Added	Yes No	
<u>INCOMPLETE INFORMATIO</u> Relevant investigations with fin Clinical Diagnosis & D/ D:	N MAY DELAY IN dings:	REPORTING	
_			
Previous Biopsy / FNAC : Yes/No	Date	Findings	
Cell phone number of the patient:			
THE LABORATORY WILL NOT RECEIVE ANY SPECIMEN WITHOUT PROPER PATIENT			

Sample Requisition form of MCWH



Histopathology tissue sections





Tissue sections stained with haemotoxylin and eosin



FROZEN SECTION

It is a technique in which tissue is quickly frozen, sectioned by cryostat and stained immediately for rapid diagnosis



FROZEN SECTION

Indications

- Rapid on table diagnosis/ during procedure (whether the tumour is benign or malignant)
- To see the resection margins of a malignant tumour
- In Hirschprung disease to see the presence ganglion cells



CRYOSTAT

- The key instrument for cryosection is the cryostat, which is essentially a <u>microtome inside a freezer</u>.
- Tissue is rapidly frozen at -20° C by liquid nitrogen





FROZEN SECTION



Section cutting in cryostat



Frozen tissue section



TUMOUR MARKERS

- Tumour markers are tumour derived or associated molecules (enzymes, hormones) that are detected in the blood or other body fluids
- These are not primary methods of diagnosis or definitive diagnosis of cancer



TUMOUR MARKERS

It may be used to

- Determine **therapeutic responses** of tumour
- Monitor tumour recurrences

They cannot be construed as primary modalities for diagnosis of tumours



Markers	Associated Cancers
Hormones	
Human chorionic gonadotropin	Trophoblastic tumors, nonseminomatous testicular tumors
Calcitonin	Medullary carcinoma of thyroid
Catecholamine and metabolites	Pheochromocytoma and related tumors



Markers	Associated Cancers
Oncofetal Antigens	
α-Fetoprotein (normally produced by fetal yolk sac & liver)	Liver cell cancer, nonseminomatous germ cell tumors of testis
Carcinoembryonic antigen (normally produced by fetal gut, liver, pancreas, stomach)	Carcinomas of the colon, pancreas, lung, stomach, and heart
Isoenzymes	
Prostatic acid phosphatase	Prostate cancer
Neuron-specific enolase	Small cell cancer of lung, neuroblastoma



Markers	Associated Cancers
Specific Proteins	
Immunoglobulins	Multiple myeloma and other gammopathies
Prostate-specific antigen and prostate-specific membrane antigen	Prostate cancer
Mucins and Other Glycoproteins	
CA-125	Ovarian cancer
CA-19-9	Colon cancer, pancreatic cancer
CA-15-3	Breast cancer
2020	



Markers	Associated Cancers
Cell free DNA Markers	
TP53, APC, RAS mutations in stool and serum	Colon cancer
<i>TP53</i> and <i>RAS</i> mutations in stool and serum	Pancreatic cancer
<i>TP53</i> and <i>RAS</i> mutations in sputum and serum	Lung cancer
TP53 mutations in urine	Bladder cancer



IMMUNOHISTOCHEMISTRY

 It involves the process of selectively identifying antigens (proteins) in cells of a tissue section by exploiting the principle of antibodies binding specifically to antigens in biological tissues.





IMMUNOHISTOCHEMISTRY

Categorization of undifferentiated

malignant tumours

- Cytokeratin points to an epithelial origin (carcinoma)
- Desmin is specific for neoplasm of muscle origin
- CD20 a marker for B cell tumour
 Determination of the site of origin of

metastatic tumours

- PSA
- Thyroglobulin

Detection of molecules that have prognostic or therapeutic significance

ER,PR in breast cancer





FLOW CYTOMETRY

 Immunophenotyping of leukaemia and lymphoma and myeloid neoplasms



CIRCULATING TUMOUR CELLS

- It is currently a research tool
- Under development



MOLECULAR and CYTOGENETIC DIAGNOSTICS

Methods

- Polymerase Chain Reaction (PCR)
- Fluorescent In Situ Hybridization (FISH)
- DNA sequencing
- DNA microarray



MOLECULAR and CYTOGENETIC DIAGNOSTICS

- Diagnosis of malignant neoplasms
- Prognosis of malignant neoplasms
- Detection of minimal residual disease
- Diagnosis of hereditary predisposition to cancer





- Sometimes called "molecular photocopying,"
- PCR is a fast and inexpensive technique used to "amplify" - copy - small segments of DNA
- Because significant amounts of a sample of DNA are necessary for molecular and genetic analyses, studies of isolated pieces of DNA are nearly impossible without PCR amplification.



FLUORESCENT IN SITU HYBRIDIZATION

 Fluorescent in situ hybridization (FISH) is a molecular cytogenetic technique that uses fluorescent probes which bind to only the complementary sequence of the chromosome



FLUORESCENT IN SITU HYBRIDIZATION



Neuroblastoma – N myc amplification



BCR-ABL fusion gene in CML

