

Radio Therapy (Radiological Physics & Radio Biology)

POST GRADUATE DEGREE STANDARD

- I. Cancer Biology
 - A. Cell Cycle
 - B. Growth of human tumours
 - C. Polypeptide and neuropeptide growth factors
 - D. Chemical Carcinogenesis
 - E. Chromosomes and cancer- Chromosomal abnormalities -myeloid leukaemia,malignant diseases affecting lymphocytes.
 - F. Physical Carcinogenesis- Ionizing radiation-Ionizing radiation and Cancer - Physical factors-Ultraviolet radiation and Carcinogenesis.
 - G. Genetics and familial Cancer
 - H. Pathogenesis of metastasis (Mechanism)
 - I. Tumour Immunology- Tumour Associated Antigens, immuno Competence and Human Cancer.

- II. Cancer Epidemiology ; Aetiology and prevention of Cancer
 - A. Cell and Molecular Mechanisms with Chemical Carcinogenesis
 - B. viral Carcinogenesis
 - C. Cellular andMolecular mechanisms in radiation Carcinogenesis
 - D. Cancer Registry organisation and function
 - E. Prospects for tumour chemoprevention
 - F. Practical application of new Cancer genetics
 - G. Evaluation of Screening for Cancer
 - H. Cancer Epidemiology and prevention

- III Diagnostic and Investigative Procedure.
 - A. Histopathological Classificationand typing of solid tumours
 - B. New techniques on pathology and their application in diagnosis and studies of tumour biology.
 - C. Cytology
 - D. Clinical approaches to pre Cancerous states.
 - E. Role of radiological imaging
 - F. Positron Emission Tomography
 - G. Magnetic resonance in Oncology.
 - H. Interventional Radiology- Percutaneous Tissue sampling
 - I. Ultrasonic scanning

- IV Specialised Techniques of diagnosis
 - A. Endoscopy - Peritoneoscopy -Colonoscopy- Oesophagoscopy-UGI endoscopy -Bronchoscopy- Mediastinoscopy -Thoracoscopy- Intra Operative Scopy

V Tumour Markers

VI Nuclear Medicine Procedure:

VII Principles of Surgical Oncology

- A. Role of surgery in Prevention Diagnosis and treatment of Cancer.

VIII Principles of Radiation Therapy

Physical Considerations:- A. Electromagnetic radiation

- 1. Roentgen
- 2. Gamma
- B. Radiation Techniques
 - 1. Teletherapy (Including conformational Therapy)
 - 2. Brachy Therapy

- a. interstitial
- b. intracavitary

IX Beam Modifying devices

X Biologic Considerations.

Interaction of radiation with Biologic Materials

Cell Survival considerations.

Survival Curves,

Repair of Radiation damage,

Oxygen Enhancement ratio (OER)

Variation of radiation response during the division cycle

Linear energy transfer

Relative biologic Effectiveness

Adverse effects of radiation

Acute and late Normal Tissue Effects.

Fractionation

Definition of Radio sensitivity,

Radio responsiveness Radiocurability

Total Body radiation

Hemi Body irradiation

Intra operative radiotherapy

Particle radio therapy

Targeted radio therapy

MEDICAL PHYSICS RELATED TO RADIATION ONCOLOGY 1.

Basic concepts

Units - Fundamental units - derived units - Electrical units - Atoms - Nucleus - Atomic Number - Mass numbers - Isotopes - Nuclear Structure - Binding Energy levels - Electromagnetic radiation - Radiation energy from an atom.

2.

Nuclear Physics

Radioactivity - Units of activity - decay - Half life - Transformation Constant-Disintegration - Electron Capture - Internal Conversion - Fission - fusion-NuclearReactors-ActivationofIsotopes.

3.

Interaction of radiation with matter

Absorption of Energy linear Attenuation co-efficient-Half value layer - Mass, electronic and atomic attenuation co-efficient-energy transfer and absorption - Photoelectric absorption Compton Scattering- Pairproduction-Total attenuationco-efficient-relative importance of different types interaction - Photon interaction

(ii) particle interaction- Electron interaction -Ionisational losses- Bremsstrahlung losses - Range of electrons - LET particles in Radiotherapy.

4.

Production of Xrays

5.

High Energy machines-Isotope Machines - ⁶⁰Cobalt unit sources Housing- Beam Commission- Penumbra- ¹³⁷Caesium- Betatron- Linear Accelerator- Microtron.

6.
Radiation Dosimetry

7.
Beam therapy - Phantoms - % Depth dose- Tissue air- ratio- Back-Scatter factor-Tissue Phantom ratio- isodose Curves- Comparison of Isodose curves of 60 Cobalt with high energy beam- Wedge filters- integraldose - choice of radiation beam.

8.
Treatment Planning - patient dose calculation -Treatment time calculation - SSA and SAD techniques - Body Contours - Contours-Corrections for tissue in homogenities - Corrections for Surface Obliqueties- Tissue Compensators.
Dose distribution -Opposing pairs of Beams-Three field Techniques -Rotation therapy-Wedge pairs Open and Wedge field Combination.
Preparation of Mould- Shielding blocks-Styrofoam cutting machines-simulator and its applications - role of CT and ultrasound in planning.

9.
Brachy therapy Sources- Radium 226, Caesium 137, Cobalt 60. Iridium 192, gold 198, Iodine 125, - Physical Characteristics, Production Storage and Transport facility.

Implant technique- types of implant- paterson parker system- Paterson parker tables-Determination of implant area - radio graphic examination of implant - Orthogonal imaging method- Stereo shift method- After loading techniques iridium 192, implant- permanent implant Examples of dose calculation.

Intracavitary paris technique-stockholm techniques, Manchester technique-Dose specification - Point A and Point B- Loading arrangement -Applications- Manual after loading system - computer dosimetry, Examples of dose calculation - Recent developments in Brachy therapy.

10.
Radiation Protection Biologic Effect of radiation - Somatic and genetic effects, intermediate and late effects - evaluation of radiation hazards - personnel monitoring - films badge pocket dosi meter - TLD - Area monitoring survey meter - survey procedure - Quality assurance in radiotherapy . Maximum permissible dose - Radiation Protection rules in India - ICRP recommendation - Dose equivalent limits - Quality factor.

Planning of radiotherapy department - workload - Occupancy and use factor - Protection from primary radiation and leakage radiation and scattered radiation - Design consideration for accelerator facility. Guideline for safe work and recent development in radiation protection.

TOTAL BODY IRRADIATION - ACUTE EFFECTS

Prodromal radiation syndrome Central nervous system cardiovascular syndrome - Gastro - intestinal syndrome, hematopoietic syndrome - Mean Lethal dose - Treatment of radiation accidents.

LATE EFFECTS - Non specific life shortening

CARCINOGENESIS

Latent period - Dose Response curve in animals - leukaemia - Breast cancer - Thyroid cancer - Bone cancer - skin cancer - lung cancer - other tumours - malignancies in prenatally exposed children. Mechanisms of radiation carcinogenesis.

RADIATION EFFECTS IN THE DEVELOPING EMBRYO AND FETUS.

1. Intrauterine death - congenital abnormalities including neonatal death - growth retardation -

Dependence of the above facts on gestation stage, dose, dose-rate. - Carcinogenesis followings in utero exposure. - Pregnant women exposed to therapeutic doses - Occupational exposure of potentially pregnant women. - Elective booking of 10 day rule. - Practical threshold for therapeutic abortion. Effects of radiation on the skin , on Bones & Cartilage , On Kidneys.

Principles of Chemotherapy

1. General aspects of Chemotherapy
2. New Drug developments
3. Antimetabolites
4. Alkylating agents
5. Anti tumour antibiotics
6. Plant alkaloids
7. Cis Platin and analogues
8. New and Miscellaneous anti Cancer drugs
9. Drug resistance
10. High dose Chemotherapy and Autologous, bone marrow rescue
11. Clinical Uses of Haematopoietic growth factors
12. Basis of Hormonal therapy of Cancer
13. Combined Chemotherapy and radiotherapy

Hyperthermia

Photodynamic therapy

Lasers In Oncology

Paper II

I Cancer of the Head and Neck

Epidemiology, Anatomy Pathology, Natural history, Methods and diagnosis treatment, principle of Treatment , General principles of Surgery radiation therapy, Chemotherapy and Combined Modalities Oral Cavity, Oropharynx, larynx, Hypopharynx, Nasopharynx, Nasal Cavity, Nasal vestibule, Paranasal sinuses, Major and minor salivary Glands.

Tumours of external auditory meatus and middle ear.

Uncommon Tumours of Head and Neck.

Management of Cervical nodes

Skin Cancers other than Melanoma

Cutaneous melanoma

Eye and Orbit

Chemotherapy with radiotherapy and or surgery

II Carcinoma lung

Pathology, Natural History, Screening studies for early diagnosis staging Surgery or Radiotherapy, Curative intention. Radiotherapy Treatment - Non small cell lung Cancer.

Small Cell Carcinoma lung.

Mesothelioma

Thymic Tumours with Myasthenia Gravis/ Bone Marrow Dyscrasias

Other Thymic Tumours Neurogenic tumour, Mesenchymal Tumours

Surgery- Pulmonary Metastases

Uncommon intrathoracic tumours.

III Cancer of Oesophagus

Epidemiology Oetiology, Pathology, Pathologic variants Anatomic considerations of Clinical significant Squamous Cell Carcinoma of Oesophagus Adeno Carcinoma of Oesophagus.

Cancer Stomach

Pathology , anatomic Relationships of Stomach

Natural History Clinica presentation staging, Prognosis, Diagnosis and Treatment

Cancer of Pancreas

Cancer Hepatobiliary system

Cancer of the small Intestines

Colo-rectal Cancer

Treatment of rectal Cancers- Special problems in Management Diagnosis of recurrent Colorectal Cancers

Cancer of Anal region

Epidemiology- Anatomy, Pathology, Natural History, Diagnosis - Assessment of prognosis-Staging-Treatment

Cancer of Kidney and Ureters

Renal AdenoCarcinoma - Chemotherapy of Hyper Nephroma,- Carcinoma of

Renal Pelvis- Carcinoma of Ureters

Cancer of the Bladder

Epidemiology, Pathology - Clinical Presentation, Staging- Treatment.

IV Cancer of the Prostate.

Epidemiology, Anatomy, History, and rroutes of spread- Pathology- Clinical Features- Staging- prognostic factors - radiotherapy - survival- Sequelae of Radio therapy and Surgery - Hormonal Therapy - Chemotherapy

V Carcinoma Urethra and Penis

Carcinoma Penis - Carcinoma of Female and Male Urethra

VI Cancer of Testes

Anatomy - Etiology, Histology, Physical diagnosis, lab investigation, Staging (Radio graphic Investigation) - Surgery - Seminoma - Non Seminomatous tumours - Radio therapy following Surgery - Adjuvant Chemotherapy - CNS Metastases - chemotherapy of disseminated diseases

VII Carcinoma Cervix

Epidemiology, Staging, pathology, diagnosis staging- Treatment of Carcinoma Cervix (Surgery, Radiotherapy, Chemotherapy)

- Carcinoma Cervix and Pregnancy

- Carcinoma of Cervical Stump

- Carcinoma of endometrium

- Carcinoma of Vagina, Vulva

- Trophoblastic Tumours

VIII Cancer of the Ovary

Epidemiology pathogenesis - pathology, Diagnosis, Staging - Stromal and Germ Cell tumours- management of mInimal residual disease after surgery - management of Stromal and Germinal ovarian Tumours

Cancer of Endocrine Glands

Thyroid Glands, Adrenal Glands, Endocrine pancreas, Carcinoid, tumours, Multiple endocrine Neoplasia syndromes.

IX Soft Tissue Sarcoma

Incidence Epidemiology, sites, pathologic classification, Benign and Malignant Tumours, Diagnosis, Staging, Unique features of individual Histologic types of Soft tissue Sarcoma- Treatment.

X Sarcomas of Bone

Classification and types of Bone Tumours, Radiographic Evaluation and diagnosis- staging- pre operative, evaluation and Biopsy considerations - Surgical Management of Skeletal tumours - Benign and Malignant Bone Tumours- Variants of Classic Osteo Sarcoma - Chondro sarcoma- Giant Cell Tumour of Bone- Malignant fibrous, Histo Cytoma- Fibrosarcoma of Bone- Chordoma- Small round Cell Sarcomas of Bone- principles of Radio therapy

XI Central Nervous System

Epidemiology, - Anatomy - Pathology- Treatment

XII Solid Tumours of Childhood

Etiology- Anatomy- Pathology, Staging and Treatment of Tumours of infants and Children (Wilm's Tumour, Neuroblastoma, Retinoblastoma, primary Hepatic Tumours, Germ Cell Tumours, Histiocytosis X syndromes

XIII Tumours of Children and Adults

Rhabdomyo Sarcoma Ewing's Sarcoma, Gynaecologic Tumours Carcinomas.

XIV Leukaemias & Lymphomas of childhood

Epidemiology - etiology - All, AML, CML, NHL, Burkitt's lymphomas, Hodgkin's diseases.

XV HODGKIN'S & NHL

Etiology, epidemiology, Microscopic anatomy of normal lymphoid tissues - cellular origin - Disease diagnosis, and staging of lymphomas - chemotherapy of NHL - Single agent Chemotherapy for NHL - place of rt in NHL - Combination chemotherapy for NHL.

ALL

Etiology, morphology, pathology, Diagnosis, and treatment.

CLL

Etology, Pathology, Diagnosis and treatment.

XVI PLASMA CELL NEOPLASM

History , Incidence, pathogenesis, Anatomic consideration, pathology dignasis, Investigation and staging screening , different diagnosis, treatment, Special probelm, Survival and causco of death, special syndromes - Future consideration.

XVII PARANEOPLASTIC SYNDROMES

Etiology, pathogenesis, endocrinologic manifestations of malignancy, neurologic mainfestations, haematologic manifestations, anaemia associated with cancer, thrombocytosis associated with cancer, unexplained thrombocytopenia in cancer, hypercaogulable state with cancer , renal manifestation in cancer paraneoplastic lesions involving the skin, gastro - intestinal paraneoplastic syndromes, miscellaneous Paraneoplastic syndromes.

XVIII CANCER OF THE UNKOWN PRIMARY SITE

Definition- Diagnostic - evaluation - Historical approach - basic screening studies - specific studies treatment.

XIX ONCOLOGIC EMERGENCIES 1. Superior venacava syndrome

2. Central Nervous system emergensies spinal cord compression, investigation, treatment, prognosis

3. Metabolic emergensies Hypercalcaemia, Hyperuraecemia, tumour lysis syndrome, lactic acidosis, adrenal failure

4. surgical emergensies General aspect - inflmmatory lesion - obstructive disease - haemorrhage - post operative

XX ABDOMINAL PROBLEMS. 1. Urologic emergencies Hematuria, obstructive uropathy

SUPPORTIVE CARE OF CANCER PATIENT

1. NUTRITIONAL SUPPORT

Etiology of malnutrition, indication of nutritional support, indication for parenteral nutrition - justification for nutritional support - therapeutic trial and efficacy.

2. USE OF BLOOD AND BLOOD PRODUCTS.

3. MANAGEMENT OF CANCER PAIN

Epidemiology, types of cancer pain, clinical assessment of pain, management of cancer pain.

ADVERSE EFFECTS OF TREATMENT

1. Hair loss
 2. nausea and vomiting
 3. Oral complication of radiation therapy and chemotherapy
 4. cardiac and pulmonary toxicity
 5. Gonadal dysfunction due to chemotherapy and radiotherapy
 6. Second cancers (after radiation, chemotherapy and host factors)
- Special care of terminally ill patients

TREATMENT OF METABOLIC DISEASE.

1. Brain, lung, liver, bone, malignant pleural effusion, malignant pericardial effusions, malignant ascites.

REHABILITATION OF CANCER PATIENT.