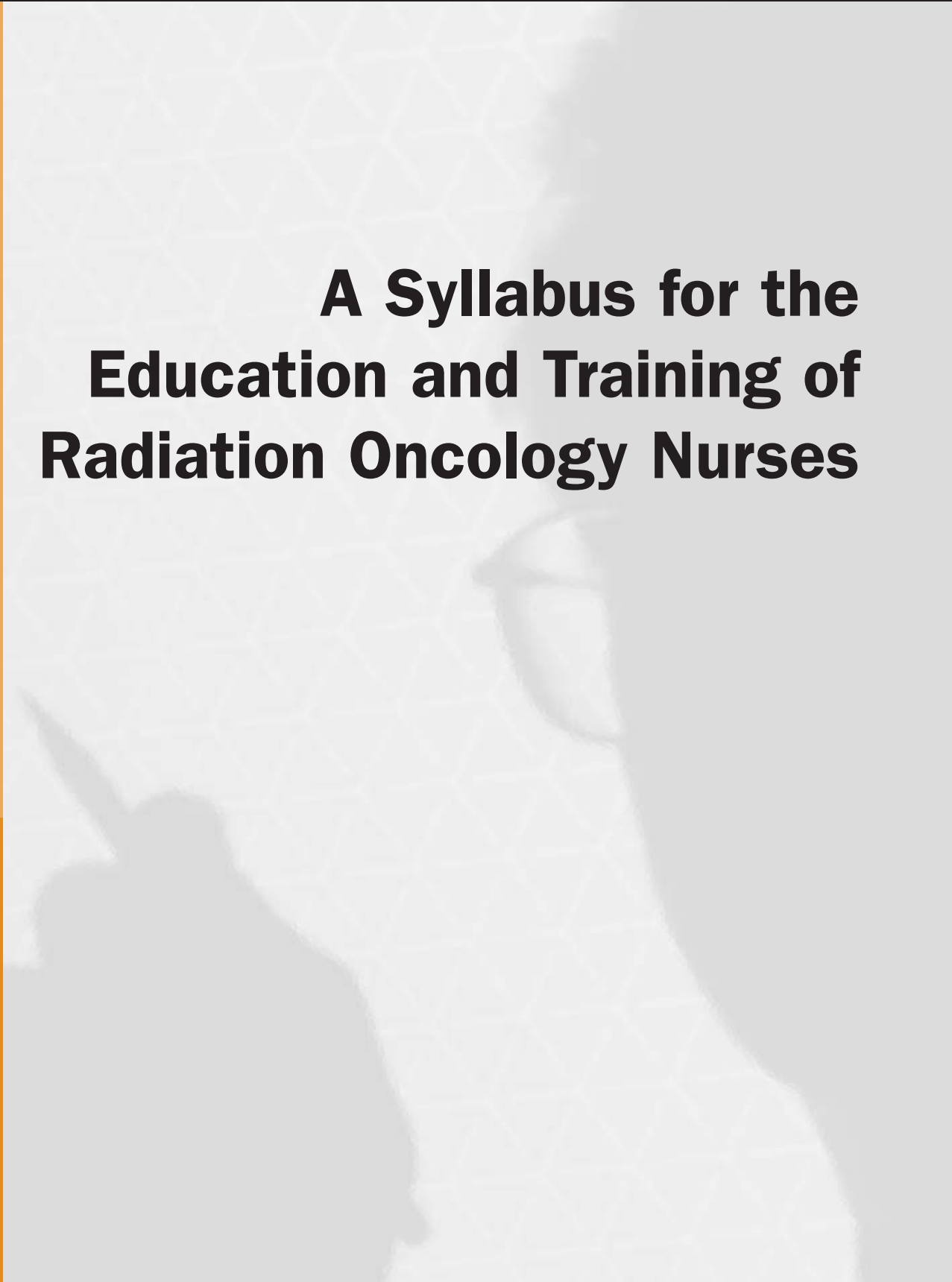


IAEA

International Atomic Energy Agency

A Syllabus for the Education and Training of Radiation Oncology Nurses



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A Syllabus for the Education and Training of Radiation Oncology Nurses

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FOREWORD

A dramatic rise in cancer incidence across the developing world is stretching already limited resources and equipment. Shortages of qualified staff and equipment are growing constraints to treating cancer efficiently. More than 5000 radiotherapy machines are presently needed to help patients fight cancer, yet the entire developing world has only about 2200 such machines. Experts predict a long term crisis in managing cancer, with an estimated five million new patients requiring radiotherapy every year.

Meeting the challenge is not simply a matter of providing appropriate equipment. There must be sufficient trained and knowledgeable staff with clinical and medical physics expertise to deliver a safe and effective radiation dose. Appropriate facilities and radiation protection infrastructure for monitoring and regulatory control are needed.

Cancer treatment must be carried out in a comprehensive context of prevention, early diagnosis and palliative care. In the early stages of development of a radiotherapy department or unit, the staffing needs of radiotherapy services should also be specifically and carefully addressed.

To make radiotherapy available to all patients who need it, human resources should be urgently expanded globally, along with the rational acquisition of additional equipment. The recommended staffing — for a basic radiotherapy facility with 1 teletherapy machine, simulator and high dose rate brachytherapy (HDR) — should be: 5 radiation oncologists, 4 medical physicists, 7–8 radiotherapy technologists (RTTs), 3 oncology nurses and 1 maintenance engineer. Where possible, training should be undertaken in centres with patient populations, equipment and training programmes relevant to the needs of the country. Radiotherapy staff should also be required to obtain a qualification adequate for registration in their own country. The human resources listed above could treat on average about 1000 patients per year by extending operations to a minimum of 12 hours per day. The equipment and staffing indicated would be sufficient to start operations, but certainly would not be sustainable without adding a training component. Hence, to qualify as a centre of “competence” a clinic should provide training to replace its own radiotherapy technologists and radiation oncology nurses. In addition, it should be able to provide financial resources to enable academic training for replacement of radiation oncologists and medical physicists as well as on-site clinical training for these professionals.

This IAEA syllabus provides the basic contents of an education course for radiation oncology nurses. It is a minimally essential syllabus which can and should be adapted to the particular needs and characteristics of the centre and country. It should be translated and used in a local language version for the training of nurses who plan to join a radiotherapy team.

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1. GENERAL CONSIDERATIONS

1.1. The role of the radiation oncology nurse

The American College of Radiology (ACR) defined the radiation oncology nursing role: “The nurse will assess and provide appropriate nursing intervention for the actual and potential problems that the patient and family may experience related to the disease process, treatment course and follow-up period. This role includes the teaching, counselling and support functions needed to assist the patient and family to cope with and adjust to the diagnosis and treatment of cancer.”

The radiation oncology nurse is a registered professional nurse who functions independently and interdependently with the radiation oncology team in providing quality patient care. The radiation oncology nurse provides clinical care, consultation and education. The radiation oncology nurse may participate in the leadership roles of clinician, educator, consultant, and/or researcher. Using an evidence-based model for practice, the radiation oncology nurse will provide assessment, diagnosis, outcome identification, planning, implementation and evaluation, focusing on the continuum of care to support the patients receiving radiotherapy, their families and caregivers.

It is recommended that the minimal background education for the radiation oncology nurse is a baccalaureate degree in nursing. Subsequent training should include a 12–16 week course, covering the theoretical aspects described in the syllabus as well as clinical practice in a radiation oncology department or unit under the direct supervision of the programme coordinator.

All nurses should be licensed to practice nursing in their respective countries. In addition, radiation oncology nursing certification is also recommended.

1.2. Standards of care

According to D. Watkins Bruner, M. Haas and T.K. Gosselin-Acomb (see bibliography) “Standards of Care” pertain to professional nursing activities demonstrated by the radiation oncology nurse through the nursing process. The nursing process is the foundation of clinical decision making and encompasses all significant action taken by nurses in providing oncology care to all patients and families. The overall goal is to influence the overall health, wellbeing and quality of life of patients and families/caregivers across the radiotherapy continuum.

Standard I – Assessment

The radiation oncology nurse assesses the needs of the patient and family throughout the continuum of care.

Standard II – Diagnosis

The radiation oncology nurse collaborates with other disciplines to analyse the assessment data and identify patient and family problems.

Standard III – Outcome identification

The radiation oncology nurse identifies expected, evidence-based nursing interventions, which will guide patient and family outcomes.

Standard IV – Planning

The radiation oncology nurse develops and communicates an individualized, comprehensive, measurable plan for interventions to attain expected outcomes.

Standard V – Implementation

The radiation oncology nurse uses evidence-based information to implement the plan of care to achieve the expected outcomes.

Standard VI – Evaluation

The radiation oncology nurse systematically evaluates patient and family responses to interventions and the process of care.

Standards of Professional Performance

Standards of Professional Performance describe a competent level of behaviour in the professional nursing role. The radiation oncology nurse should be self-directed and purposeful in seeking the necessary knowledge and skills to enhance professional development and clinical outcomes.

Standard I – Quality of care

The radiation oncology nurse systematically evaluates and documents the effectiveness of clinical care.

Standard II – Accountability

The radiation oncology nurse evaluates his or her own nursing practice in relation to professional practice standards, relevant statutes and regulations.

Standard III – Education

The radiation oncology nurse, building upon the fundamentals of nursing, will participate in ongoing education activities and update knowledge pertaining to basic and behavioural sciences, technology and information systems.

Standard IV – Leadership

The radiation oncology nurse serves as a leader, role model, and mentor for the professional development of peers and colleagues.

Standard V – Ethics

The radiation oncology nurse serves as patient and family advocate, protecting personal health information and patient autonomy, dignity and rights in a manner sensitive to spiritual, cultural and ethnic practices.

Standard VI – Collaboration

The radiation oncology nurse collaborates and consults with patient and family, along with the multidisciplinary team, to enhance desired clinical outcomes.

Standard VII – Research

The radiation oncology nurse uses research as the scientific base for all nursing practice and participates in the conduct of research to improve patient outcomes.

Standard VII – Resource utilization

The radiation oncology nurse strives to maintain the clinical aspect of the role, ensuring his or her expertise is primarily used for direct patient care, and healthcare institutions should recognize their expertise in allowing them to function at the highest level of patient care. Consideration will be given to patient and family safety, effectiveness of care, and securing of appropriate services and financial resources as needed.

1.3. Course description

The didactic portion of this course is designed to prepare the registered nurse to practice in a radiation oncology setting. Course topics include the following:

- Principles and properties of ionizing radiation and basic concepts of radiobiology;
- The purposes of radiotherapy as a cancer treatment modality;
- General principles of patient and family education (radiotherapy specific);
- Nursing assessment and management of site-specific cancers;
- Nursing assessment and management of radiotherapy-related symptoms;
- Psychosocial and supportive care issues;
- Description of modality-specific management, including newer and specialized techniques;
- Principles of radiation protection;
- Radiotherapy palliative care;
- Radiation oncology resources.

1.4. Course objectives

At the completion of the didactic portion of this course, the nurse will be able to:

- Discuss the principles and purposes of radiotherapy;
- Describe the basic principles of radiobiology;
- Assess patients undergoing radiotherapy for actual or potential problems and for general and site-specific side effects;
- Assess the psychosocial impact of cancer diagnosis and treatment on the patient and family;
- Formulate a plan of care for a patient receiving radiotherapy, including patient assessment, symptom management, patient/family education, measurable outcomes and evaluation criteria;
- Teach the patient and family about the radiotherapy procedures and their potential side effects, and provide instruction on appropriate self-care measures;
- Describe the nursing management of the patient receiving external beam radiotherapy, low dose rate and high dose rate intracavitary brachytherapy.

1.5. Participants' qualifications

It is recommended that the minimal education for the radiation oncology nurse is a baccalaureate degree in nursing. Subsequent education should include a 12–16 week course,

covering the theoretical aspects described in the syllabus as well as clinical practice in a radiation oncology department or unit under the direct supervision of the programme coordinator.

1.6. Course duration

12–16 weeks, 5 days per week (depending on the local needs of the oncology setting).

1.7. Student evaluation

The final student's evaluation should include all or some of the following elements:

- Student's assessment sheet of special competencies and practical skills;
- Submission and approval of a "Patient Case Study";
- Multiple choice questionnaire (MCQ) final examination;
- Evaluation of professional development.

2. CURRICULUM

2.1. Role of the radiation oncology nurse

Definition of terms

2.1.1. *Standards of care*

2.1.2. *Standards of professional performance*

2.1.3. *Evidence-based practice*

2.1.4. *Clinical practice*

Recommended sources for teaching:

WATKINS BRUNER, D., Manual for Radiation Oncology Nursing Practice and Education, (WATKINS BRUNER, D., HAAS, M.L., GOSSELIN-ACOMB, T.K., eds) Oncology Nursing Society, Pittsburgh, PA, 3rd ed (2004).

2.2. Introduction to oncology

Definition of terms

2.2.1. *Pathophysiology*

Epidemiology

Carcinogenesis

Principles of staging

Mechanisms of cancer spread

2.2.2. *Types of cancer*

2.2.3. *Second primary malignant tumours*

2.2.4. *Principles of management*

2.2.5. *Importance of follow-up*

2.2.6. *Psychosocial impact and consequences of cancer diagnosis and treatment*

Recommended sources for teaching:

JONES & BARLETT, A Cancer Source Book for Nurses, American Cancer Society, 8th Ed. Sundbury, M.A. (2004).

LENHARD JR, R.E., OSTEEN, R.T., GENSLER, T., Clinical Oncology, American Cancer Society, Atlanta, GA (2001).

2.3. Radiotherapy (RT)

Radiotherapy is a clinical modality dealing with the use of ionizing radiation in the management of patients with malignant neoplasias (and occasionally benign disease).

2.3.1. ***Historical development of RT***

2.3.2. ***Radiotherapy department***

Radiotherapy team

Clinical service role of each member of the RT team

2.3.3. ***Quality assurance***

2.3.4. ***Principles of radiation***

Goals of treatment approaches curative vs. palliative

Basic concepts of medical radiation physics

Radiobiology

Radiobiology is the study of events that occur after ionizing radiation is absorbed by a living organism. Ionizing radiation can result in breaking of chemical bonds and, eventually, in biological change. The nature and severity of effects and the time in which they appear depend on the amount and type of radiation absorbed and the rate at which it is administered. Early- and late-responding tissues are affected differently by these factors. Interaction of radiation in cells is random and has no selectivity for any structure or site.

Radiosensitivity

Cell response

Chemical and thermal modifiers of radiation

Ionizing radiation

Photons

Electrons

Heavier particles

2.3.5. ***Radiotherapy planning process***

Treatment plan

Simulation process

Patient positioning and immobilization techniques

2.3.6. ***Treatment delivery techniques***

RT machines

Cobalt-60

Linacs

HDR brachytherapy

2.3.7. *External beam radiotherapy (Teletherapy)*

External beam radiotherapy (EBRT) is the delivery of radiation from a specified distance to a defined target volume to cure, control or palliate a tumour within the defined field or in special cases as an adjuvant to surgery. The student should be able to describe the basic differences between cobalt-60 and linear accelerator teletherapy units. The principles of external beam radiotherapy techniques and dose prescription should be discussed.

Principles

Special techniques of radiation delivery

Total body irradiation (TBI)

Definition

Principles and rationale

Indications

Techniques and doses

Toxicity: acute and late

Intraoperative radiotherapy (IORT)

Image guided radiotherapy (IGRT)

Three-dimensional conformal radiotherapy (3D-CRT)

Intensity modulated radiotherapy (IMRT)

Stereotactic radiotherapy

Radiosurgery

Recommended sources for teaching:

MIESKALSKI, G.B., BRADY, L.W., YAEGER, T.E., CLASS, R., "Radiotherapy" in Clinical Oncology. (LENHARD Jr., R.E., OSTEEB, R.T., GENSLEER, T., eds) American Cancer Society, Atlanta, GA (2001).

2.3.8. *Brachytherapy*

Brachytherapy (BT) is the temporary or permanent placement of a radioactive source into a body cavity (intracavitary), into a hollow organ (intraluminal) or into the tissue (interstitial). Brachytherapy may be used by itself or as an adjunctive treatment in combination with external beam therapy to increase the total dose to a specified target. Brachytherapy is the optimal way of delivering conformal radiotherapy tailored to the shape of the tumour while sparing surrounding normal tissues. Knowledge of specific radionuclide types and techniques is important to the radiation oncology nurse. With temporary sealed source implants, the patient is not radioactive, only the source is radioactive. Once the implanted source is removed, the patient no longer needs to be treated with any special precautions.

Principles

Low dose rate (LDR)/High dose rate (HDR) brachytherapy.

Radioactive source therapy

Commonly used radioactive elements

Sealed sources: Co-60, Cs-137, Ir-192, I-125

Unsealed sources: I-131, P-32, Sr-90

Special techniques

Gynaecology (GYN)

Prostate

Breast

Head-and-neck

Soft-tissue Sarcomas

Nursing considerations

Acute and late effects

Coordination activities

Operating room (OR) techniques and principles

Familiarity with GYN applicators and procedures

Pain control and anaesthesia

Counselling the BT patient and family

Recommended sources for teaching:

WATKINS BRUNER, D., Radiation Oncology Nursing Practice and Education: Manual for Radiation Oncology Nursing Practice and Education, (WATKINS BRUNER, D., HAAS, M.L., GOSELIN-ACOMB, T.K., eds) Oncology Nursing Society, Pittsburgh, PA, 3rd ed (2004).

2.3.9. Combined modality therapy

Concurrent (also called concomitant) chemotherapy is chemotherapy given at the same time as radiotherapy, resulting in a greater effect on the tumour cells than either agent given alone, with acceptable toxicity. The concomitant administration of chemotherapy and radiotherapy has yielded better clinical results than induction or adjuvant chemotherapy. Since the radiation oncology nurse will often be managing the toxicity of these combined modality therapies, she/he should be familiar with this treatment approach and its possible adverse effects.

Basic concepts in cancer chemotherapy

Commonly used chemotherapeutic drugs and radiosensitizers

Surgery and radiotherapy

Pre-operative

Post-operative

Recommended sources for teaching:

WATKINS BRUNER, D., Radiation Oncology Nursing Practice and Education: Manual for Radiation Oncology Nursing Practice and Education, (WATKINS BRUNER, D., HAAS, M.L., GOSELIN-ACOMB, T.K., eds) Oncology Nursing Society, Pittsburgh, PA, 3rd ed (2004).

Radiation adverse events (Toxicities)

Tumours as well as normal tissues are affected by ionizing radiation. The time in which toxicities appear and the severity of effects depend on the amount of radiation absorbed, fractionation and rate at which it is administered. Acute (early) and late toxicities are to be expected.

The radiation oncology nurse should be familiar with the identification and management of acute and late adverse events of radiotherapy in the various organs and systems.

2.3.10. Tissue/organ response

Acute effects

Sub-acute effects

Late effects

Generic

Consequential

2.3.11. General symptoms management

Acute skin and mucosal reactions

Myelosuppression

Fatigue

Nutritional status

2.3.12. Site specific management

2.3.12.1. Central nervous system (CNS)

Overview

Common cancers

Signs and symptoms

Diagnoses

Treatment approach

Prognosis

Acute toxicity

Alopecia and scalp erythema

Ear and external auditory canal

Cerebral oedema

Nausea and vomiting

Late toxicity

Cognitive dysfunction

Neurological deficits

Hearing deficits

Visual deficits

Brain necrosis

2.3.12.2. Head and Neck

Overview

Common cancers

Signs and symptoms

Diagnoses

Treatment approach

Prognosis

Acute toxicity

Mucositis

Dermatitis

Oral infections

Xerostomia

Oesophagitis/pharyngitis

Taste changes

Late toxicity

Taste changes

Xerostomia

Dental caries

Fibrosis

Hypothyroidism

Radiation myelitis

Osteoradionecrosis

2.3.12.3. *Breast*

Overview

Common cancers

Signs and symptoms

Diagnoses

Treatment approach

Prognosis

Acute toxicity

Skin reaction

Dysphagia

Arm oedema

Shoulder dysfunction

Radiation pneumonitis

Late toxicity

Skin fibrosis

Telangiectasia

Rib fractures

Cardiotoxicity

Cosmetic defects

2.3.12.4. *Thoracic*

Overview

Common cancers

Signs and symptoms

Diagnoses

Treatment approach

Prognosis

Acute toxicity

Oesophagitis/pharyngitis

Taste changes

Pneumonitis (acute or sub-acute)

Late toxicity

Radiation pneumonitis

Cardiotoxicity

Neurotoxicity

Skin fibrosis

2.3.12.5. *Gastrointestinal and abdomen*

Overview

Common cancers

Signs and symptoms

Diagnoses

Treatment approach

Prognosis

Acute toxicity

Nausea and vomiting

Weakness

Diarrhoea and enteritis

Late toxicity

Chronic enteritis

Renal dysfunction

Liver failure

2.3.12.6. *Pelvic*

Overview

Common cancers

Signs and symptoms

Diagnoses

Treatment approach

Prognosis

Acute toxicity

Weakness

Diarrhoea and proctitis

Cystitis and haematuria

Late toxicity

Vaginal dryness

Chronic enteritis

Chronic cystitis

Chronic proctitis

Infertility

Sexual dysfunction: male/female

Pelvic fibrosis

2.3.12.7. *Eyes*

Overview

Common cancers

Signs and symptoms

Diagnoses

Treatment approach

Prognosis

Acute toxicity

Conjunctival oedema and tearing

Late toxicity

Cataract

Retinopathy

2.3.12.8. *Soft tissue sarcoma*

Overview

Common types

Signs and symptoms

Diagnoses

Treatment approach

Prognosis

Acute toxicity

Skin reaction

Late toxicity

Fibrosis

Telangiectasia

Ulceration

Deformities

Joint dysfunctions

2.3.12.9. *Skin*

Overview

Common cancers

Signs and symptoms

Diagnoses

Treatment approach

Prognosis

Acute toxicity

Epilation

Erythema

Desquamation

Dryness

Ulceration

Late toxicity

Hyperpigmentation

Fibrosis

Telangiectasia

Chronic ulceration

Recommended sources for teaching:

ROSENTHAL, P.E., "Complications of Cancer and Cancer Treatment" in *Clinical Oncology*, (LENHARD Jr, R.E., OSTEEEN, R.T., GENSLER, T., eds), American Cancer Society, Atlanta, GA (2001).

2.3.13. *Radiation induced malignancies*

Definition and criteria

Management and prognosis

2.4. Paediatric radiation oncology

Radiotherapy has a significant role in the modern management of a number of paediatric tumours. These include tumours of the central nervous system, Wilm's tumour, neuroblastoma, rhabdomyosarcoma, Ewing's sarcoma and lymphomas. Childhood cancers differ from those that occur in the adult. The majority of childhood cancers arise from the mesodermal germ layer giving rise to sarcomas, while the majority of adult cancers arise from tissue of epithelial origin giving rise to carcinomas.

There are special issues associated with treating children with radiation: these include developmental considerations, psychosocial issues, nutritional problems, immobilization and sedation issues and the potential for late radiation effects.

2.4.1. Common paediatric malignancies treated with RT

2.4.2. Special techniques and approaches

2.4.3. Dose/technique modifications in children

2.4.4. Sedation and anaesthesia

2.4.5. Acute effects (site dependent)

2.4.6. Late effects

Growth retardation

Cognitive dysfunctions

Organ failure

Infertility

Cosmetic defects

Radiation induced malignancies

2.4.7. Nursing considerations

Coordination activities

Counselling of the paediatric patient and family

Recommended sources for teaching:

MARCUS, K.C., "Paediatric Solid Tumors" in Clinical Oncology, (LENHARD Jr, R.E., OSTEEEN, R.T., GENSLER, T., eds), American Cancer Society, Atlanta, GA (2001).

KLINE, N.E., TOMLINSON, D., (Eds), Pediatric Oncology Nursing: Advanced Clinical Handbook, Springer Publishing Co, New York (2004).

2.5. Palliative radiotherapy

There are many clinical settings in oncology where radiotherapy can either prevent serious clinical problems (paraplegia, blindness) or alleviate the symptoms produced by the tumour or its metastasis (pain, bleeding and obstruction). Palliative radiotherapy is of value in life-threatening situations, such as profuse bleeding from a tumour or compression of the superior vena cava, in cases of pain secondary to bone metastasis, spinal cord compression or cerebral metastasis. A single treatment or a small number of treatments will often have a significant palliative effect while at the same time being the most cost-effective form of palliation.

2.5.1. Definition and purpose

2.5.2. Decision making

2.5.3. Quality of life (QOL) issues

Pain

Fatigue

Comfort

Daily activities

2.5.4. End-of-life care

2.5.5. Do-not-resuscitate (DNR) orders

Recommended sources for teaching:

KUEBLE, K.K., ESPER, P., (Eds), *Palliative Practices from A–Z for the Bedside Clinician*, Oncology Nursing Society, Pittsburgh, PA (2002).

O’CONNOR, M., ARANDA, S., *Palliative Care Nursing: A Guide to Practice*, 2nd ed, Ausmed Publications, London (2003).

FAITHFULL, S., WELLS M., *Supportive Care in Radiotherapy*, Churchill Livingstone, Edinburgh, UK (2003).

KING CR., HINDS, P.S., (Eds), *Quality of Life: From Nursing and Patient Perspectives*, St. Jude Children’s Research Hospital, Jones and Bartlett Publishers, Sudbury MA. 2nd ed, (2003)

2.6. Radiotherapy emergencies

An oncological emergency is defined as a potential life-threatening or function-threatening event directly or indirectly related to a patient’s neoplasm or subsequent to its treatment. The emergency could be due to direct or indirect compression of organs, occlusion of vital structures such as blood vessels, nerves or airway. Radiotherapy plays a significant role in the acute treatment of these clinical situations. Radiotherapy relieves symptoms by local cytoreduction of the tumour, thereby removing compression to the affected organ or structure.

- 2.6.1. *Spinal cord compression*
- 2.6.2. *Superior vena cava syndrome*
- 2.6.3. *Increased intracranial pressure*
- 2.6.4. *Bleeding*

Recommended source for teaching:

DEMICHELE, A., GLICK, J.H., “Cancer-related Emergencies”, Clinical Oncology (LENHARD Jr., R.E., OSTEEN, R.T., Eds) American Cancer Society, Atlanta, GA, USA (2001).

2.7. Counselling

Psychotherapy covers a range of techniques which use only dialogue and communication and which are designed to improve the mental health of a patient or to improve group relationships (such as in a family). Most forms of psychotherapy use only verbal conversation, though some also use various other forms of communication such as the written word, artwork or touch. Therapy may address specific forms of diagnosable mental illness, or everyday problems in relationships or meeting personal goals. Treatment of everyday problems is more often referred to as counselling but the term is sometimes used interchangeably with “psychotherapy”.

Psychotherapeutic interventions are often designed to treat the patient following the “medical model”, although not all psychotherapeutic approaches follow the model of “illness/cure”. Some practitioners, such as the humanistic school, see themselves in an educational or helper role. Because sensitive topics are often discussed during psychotherapy, counsellors and therapists are expected, and usually legally bound, to respect patient confidentiality.

In the specific context of the oncology patient, the radiation oncology nurse will learn to identify and assess the most frequent forms of distress and provide initial counselling. In many instances, he/she will make a decision on the need to refer the patient to a specialized professional in psychotherapy or psychiatry.

- 2.7.1. *Patient and family education*
- 2.7.2. *Psychosocial responses*
- 2.7.3. *Emotional distress*
- 2.7.4. *Coping, body image*
- 2.7.5. *Sexuality and sexual dysfunction*
- 2.7.6. *Spiritual needs*
- 2.7.7. *Complementary forms of healing*
- 2.7.8. *Nutrition*
- 2.7.9. *Ethical considerations*

2.7.10. *Assessment*

2.7.11. *Management*

Recommended sources for teaching:

BURKE, C.C., Psychosocial Dimensions of Oncology Nursing Care, Oncology Nursing Press, Pittsburgh, PA (1998).

2.8. Radiation protection

Radiation protection, sometimes known as radiological protection, is the science of protecting people and the environment from the harmful effects of both particle and ionizing radiation. It includes occupational radiation protection, which is the protection of workpeople, medical radiation protection, which is the protection of patients, and public radiation protection, which is the protection of individual members of the public and of the population as a whole. There are mainly three principles of radiation protection: those of time, distance and shielding. ALARA “as low as reasonably achievable” is a guideline used for radiation protection. The principle of ALARA is to minimize radiation exposure to workers, taking economic and social factors into account (NCRP, 1990).

The radiation oncology nurse is a member of the team dealing with cancer patients treated with radiotherapy and brachytherapy. As such she/he should be familiar with the basic concepts of radiation protection.

2.8.1. *Absorbed dose and units*

Dose equivalent (sievert -Sv)

Dose equivalent limit (annual)

Incidents and accidental exposures

Principles of radiation protection

2.8.2. *“ALARA”*

Linear non-threshold model

2.8.3. *Time: how to minimize exposure time*

2.8.4. *Distance: how to maximize distance*

2.8.5. *Shielding: how to optimize shielding*

2.8.6. *Hazards of radiation exposure*

Somatic effects

Genetic effects

Stochastic effects

Deterministic (non-stochastic) effects

2.8.7. ***Radiation protection committee***

Radiation Safety Officer (RSO)

Radiation source log sheet

2.8.8. ***Radiation monitoring devices***

Identification of radiation-restricted areas

Area monitors

Types of personal dosimetry monitors

Film badge

Ring badge

Pocket dosimeter

Special populations

Pregnant women

2.8.9. ***Discharge regulations***

Discharge regulations for unsealed radiopharmaceuticals

2.8.10. ***Discharge regulations for patients with permanent prostate implants***

2.8.11. ***Patient, family and the general public concerns about radiation***

Recommended source for teaching:

WATKINS BRUNER, D., Radiation Oncology Nursing Practice and Education: Manual for Radiation Oncology Nursing Practice and Education, (WATKINS BRUNER, D., HAAS, M.L., GOSSELIN-ACOMB, T.K., eds) Oncology Nursing Society, Pittsburgh, PA, 3rd ed (2004).

2.8.12. ***Emergency situations***

As opposed to the “radiotherapy emergencies” (oncological emergencies that require radiotherapy) listed above, these refer to emergency situations related to the radioactive sources/materials or to medical emergencies occurring in a patient who is being treated with radionuclides.

The radiation oncology nurse should be trained to identify these situations and act promptly following accepted codes of conduct to reduce patient and staff exposure.

Radiation emergencies

Dislodged source

Rupture of sealed source

Radioactive spills

Medical emergencies

Patients with sealed radionuclides

Patients with unsealed sources

Periodic in-service instruction on radiation protection

Patient and family education

2.9. Documentation

2.10. Quality assurance (QA) programme

Quality Assurance in radiotherapy consists of procedures that ensure a consistent and safe fulfilment of the dose prescription to the target volume with minimal dose to normal tissues and minimal exposure to personnel and the public. It involves both clinical and physical aspects.

2.10.1. Components of a QA programme

2.10.2. RT treatment chart

2.10.3. Nursing record (inpatients) or checklist

Nursing assessment

Nursing diagnosis

Expected outcomes

Plan of care and patient education

Implementation

Evaluation

Recommended source for teaching:

WATKINS BRUNER, D., Radiation Oncology Nursing Practice and Education: Manual for Radiation Oncology Nursing Practice and Education, (WATKINS BRUNER, D., HAAS, M.L., GOSSELIN-ACOMB, T.K., eds) Oncology Nursing Society, Pittsburgh, PA, 3rd ed (2004).

Competency based practice

The practicing radiation oncology nurse is expected to develop skills in a number of practical tasks directly related to his/her competencies in the daily work in a radiotherapy department or unit.

Upon completion of the training course, the student should demonstrate competency in the following tasks, which will in turn be evaluated as part of the overall student evaluation process (Appendix VI, VI.1).

- 2.10.4. *Skin/wound assessment and care*
- 2.10.5. *Assessment and management of the oral cavity*
- 2.10.6. *Assessment and management of fatigue*
- 2.10.7. *Assessment and management of the nutritional status*
- 2.10.8. *Assessment of the patient to receive brachytherapy or unsealed radionuclides*
- 2.10.9. *Counselling in brachytherapy*
- 2.10.10. *Care for the brachytherapy patient treated with sealed or unsealed sources*
- 2.10.11. *Counselling in external beam radiotherapy*
- 2.10.12. *Counselling for children and their family*
- 2.10.13. *Assessment and management of psychosocial/emotional distress*
- 2.10.14. *Assessment and evaluation of patient learning*
- 2.10.15. *Stoma care*
- 2.10.16. *Assistance in the performance of gynaecological and other brachytherapy procedures*
- 2.10.17. *Paediatric catheters care*
- 2.10.18. *Handling of radiotherapy emergencies*
- 2.10.19. *Lymphoedema care*
- 2.10.20. *Care of the laryngectomy patient*
- 2.10.21. *End-of-life care*
- 2.10.22. *Application of radiation protection principles*

APPENDIX I GLOSSARY

Listed below are the definitions of cancer-related terms in alphabetical order.

Adjuvant therapy – Any form of therapy used as adjunct to other local modalities as part of the initial curative treatment to avoid a disease recurrence in high-risk patients.

Anaesthesia – The loss of feeling or sensation as a result of drugs. General anaesthesia causes temporary loss of consciousness (“puts you to sleep”). Local or regional anaesthesia numbs only a certain area.

Angioplasty – Dilatation of an occluded blood vessel. This can be done by inflating a balloon catheter to restore blood supply.

Benign tumour – An abnormal non-cancerous growth that does not spread to other sites in the body.

Biopsy – The removal of a sample of tissue to see whether cancer cells are present. There are several kinds of biopsies. In some, a very thin needle is used to draw fluid and cells from a lump. In a core biopsy, a larger needle is used to remove significantly more tissue.

Brachytherapy – Internal radiation treatment given by placing radioactive material directly into a tumour or close to it. Also called interstitial radiotherapy, intracavitary radiotherapy, intravascular radiotherapy, or seed implantation.

Cancer – Cancer develops when cells in the body begin to grow out of control. Normal cells grow, divide, and die. Instead of dying, cancer cells continue to grow and form new abnormal cells. Cancer cells often travel to other body parts where they grow and replace normal tissue. This process, called metastasis, occurs as the cancer cells get into the bloodstream or lymph vessels.

Carcinogen – A substance known to cause cancer.

Carcinoma – A malignant tumour that begins in the lining layer (epithelial cells) of organs. At least 80% of all cancers are carcinomas.

Catheter – A thin, flexible hollow tube. Catheters can be used to allow fluids to enter or leave the body. Catheters can also be used to insert temporary radioactive sources into tumours, as in breast brachytherapy or high dose rate prostate brachytherapy.

Cervix – The lower, narrow end of the uterus that forms a canal between the uterus and vagina.

Chemotherapy – Treatment with drugs to destroy cancer cells. Chemotherapy is often used alone or with surgery or radiation to treat cancer.

CT scan – Computed tomography scan. A series of detailed pictures of areas inside the body taken from different angles; the pictures are created by a computer linked to an X-ray machine. Also called computerized tomography and computerized axial tomography (CAT) scan.

External beam radiotherapy (external radiation) – Radiotherapy that uses a machine outside of the body to deliver high-energy rays directed at the cancer or tumour.

Gleason score – A system of grading prostate cancer cells describing how aggressive the cancer appears. It is used to determine the best treatment and to predict how well a person is likely to respond to treatment. The lower the Gleason score, the closer the cancer cells are to normal cells, the higher the Gleason score, the more abnormal the cancer cells.

High dose rate remote brachytherapy (HDR) – HDR temporary brachytherapy involves placing very tiny plastic catheters into the treatment area, and then giving radiation treatments through these catheters over a temporary period. With HDR temporary brachytherapy, a computer-controlled machine pushes a single highly radioactive source into the catheters one by one.

Multidisciplinary care team – Multidisciplinary care is a team approach to the provision of healthcare by all relevant medical and allied health disciplines as a means of achieving best practice. Through their combined understanding, all members of the team liaise and cooperate together and with the patient to diagnose, treat and manage the condition to the highest possible standard of care. In the case of the cancer patient, the multidisciplinary team normally includes the radiation oncologist, surgeon, the medical oncologist, medical physicist, radiation oncology nurse, radiotherapy technologist, psychologist, social worker and/or other specialists.

Internal radiation – A procedure in which radioactive material sealed in needles, seeds, wires, or catheters is placed directly into or near a tumour. Also called brachytherapy, implant radiation, or interstitial radiotherapy.

Interstitial radiation – A procedure in which radioactive material sealed in needles, seeds, wires, or catheters is placed directly into or near a tumour. Also called brachytherapy, internal radiation, or implant radiation.

Intracavitary radiation – A radioactive source (implant) placed in a body cavity such as the cervix or oesophagus.

Low dose rate brachytherapy (LDR) – Brachytherapy in which sources are left in place for the duration of treatment. This includes temporary LDR in which patients are hospitalized for several days of temporary brachytherapy. It also includes permanent LDR in which seeds are permanently placed.

Lymph node (lymph gland) – A rounded mass of lymphatic tissue that is surrounded by a capsule of connective tissue. Lymph nodes are spread out along lymphatic vessels and contain many lymphocytes, which filter the lymphatic fluid (lymph). Lymph nodes are part of the body's immune system.

Malignant – A cancerous growth with a tendency to invade and destroy nearby tissue and spread to other parts of the body.

Medical oncologist – A doctor who specializes in diagnosing and treating cancer using chemotherapy, hormonal therapy, and biological therapy.

Metastasis – The spread of cancer from one part of the body to another. Tumours formed from cells that have spread are called *secondary tumours* and contain cells that are like those in the original (primary) tumour.

Oncologist – A doctor who specializes in treating cancer. Some oncologists specialize in a particular type of cancer treatment. For example, a radiation oncologist specializes in treating cancer with radiation.

Palliative care – Care given to improve the quality of life of patients who have a serious or life-threatening disease. The goal of palliative care is to prevent or treat as early as possible the symptoms of the disease, side effects caused by treatment of the disease, and psychological, social, and spiritual problems related to the disease or its treatment. Also called comfort care, supportive care, and symptom management.

Permanent interstitial implant – A procedure in which radioactive material sealed in seeds is placed directly into or near a tumour. Also called brachytherapy, internal radiation, or implant radiation. While the radioactivity decays away, the actual seeds remain indefinitely.

Prostate – A gland in the male reproductive system just below the bladder. The prostate surrounds part of the urethra, the canal that empties the bladder, and produces a fluid that forms part of semen.

Psychosocial distress – In the context of cancer, distress has been defined as a multifactor unpleasant emotional experience of a psychological (cognitive, behavioural, emotional), social, and/or spiritual nature that may interfere with the ability to cope effectively with cancer, its physical symptoms, and its treatment. Feelings of distress range along a continuum, from sadness and vulnerability to disabling depression.

Radiation – Radiant energy given off by X ray machines, radioactive substances, rays that enter the Earth's atmosphere, and other sources.

Radiation dosimetrist – A specialist who measures the amount of radiation exposure during treatment procedures.

Radiation oncologist – A doctor who specializes in using radiation to treat a variety of diseases including cancer.

Radiation physicist – A person who makes sure that the radiation machine or implant delivers the right amount of radiation to the correct site in the body. The physicist works with the radiation oncologist to choose the most suitable treatment schedule and dose.

Radiation therapist – A health professional who gives radiation treatment.

Radiotherapy – The use of high-energy radiation from X rays, gamma rays, neutrons, and other sources to kill cancer cells and shrink tumours. Radiation may come from a machine outside the body (external beam radiotherapy), or it may come from radioactive material placed in the body near cancer cells (internal radiotherapy, implant radiation, or brachytherapy). Systemic radiotherapy uses a radioactive substance, such as a radiolabelled monoclonal antibody, which circulates throughout the body.

Restenosis – Narrowing of a blood vessel (usually a coronary artery) following the removal or reduction of a previous narrowing (angioplasty).

Seeds – Radioactive pellets, approximately the size of a grain of rice, used in brachytherapy.

Stage – The extent of a cancer within the body, especially whether the disease has spread from the original site to other parts of the body.

Stent – A device placed in a body structure — such as a blood vessel or the gastrointestinal (GI) tract) — to provide support and keep the structure open.

Supportive care – Treatment given to prevent, control, or relieve complications and side effects and to improve the comfort and quality of life of people who have cancer.

Temporary interstitial implant – A procedure in which radioactive material sealed in needles, seeds, wires, or catheters is temporarily placed directly into or near a tumour.

Tumour – An abnormal mass of tissue that results from excessive cell division. Tumours perform no useful body function. They may be benign (not cancerous) or malignant (cancerous).

Tumour staging – This is an important step in the management of cancer. Typically, several tests are performed to determine three things. The first part is to quantify the size and extent of a primary cancer. The second is to determine whether the cancer involves nearby lymph nodes. The third is to check whether cancer has spread through the blood stream to other parts of the body. Using this information, people with cancer are assigned a stage. This helps to determine the best course of

treatment and it also predicts the response to treatment. Each type of cancer has a specific staging system.

Ultrasound – A test that bounces sound waves off tissues and internal organs and changes the echoes into sonograms (pictures).

Unsealed internal radiotherapy – Radiotherapy given by injecting a radioactive substance into the bloodstream or a body cavity, or by swallowing it. This substance is not sealed in a container.

Vascular – Relating to or containing blood vessels.

Volume study – This is a procedure used in prostate brachytherapy to map out the prostate gland. An ultrasound probe is placed in the rectum to get images of the prostate. Once the map is made, a computer plan is generated to show the best place to put radioactive seeds in and around the prostate. This is often done before or during a prostate implant procedure.

APPENDIX II STANDARDIZED NURSING CARE PLANS

The nursing care plan is an essential part of nursing practice that provides a written means of planning patient care and discharge based upon the nursing diagnosis. Nursing care plans function as a means of communicating patient care needs between members of the nursing team to ensure those needs are met. Written nursing care plans also serve as a means to document changes in a patient's condition, adjustments or additions to nursing diagnosis, as well as a patient's response to nursing and medical treatment. Nursing care plans enable nurses to provide a holistic approach to patient needs both while hospitalized and after discharge.

The nursing care plan should be "problem oriented" meaning that each plan will address one specific problem presented by the patient. Occasionally one plan can be subdivided into several sub-problems to be addressed separately. For example:

- Psychosocial distress
 - Anxiety
 - Ineffective coping
 - Disturbed body image
 - Sexual dysfunction

Normally a nursing care plan includes the following components:

- (1) Nursing diagnosis
- (2) Expected outcomes (or goals)
- (3) Nursing interventions (or actions)
- (4) Evaluation

The following standardized care plans are offered as an orientation tool for the radiation oncology nurse student dealing with problems and side effects frequent in the oncology patient treated with radiotherapy:

- Bone marrow suppression
- Nausea and vomiting
- Stomatitis
- Diarrhoea
- Neuropathy
- Psychosocial distress

II.1. Nursing Care Plan for Patient Experiencing Bone Marrow Suppression (BMS)

II.1.1. Nursing diagnosis: potential for infection, bleeding related to BMS

Expected outcomes:

- The patient will remain free of infection, bleeding;
- The patient will experience minimal complications of BMS as evidenced by normal temperature, neutrophil count and absence of bleeding.

Nursing intervention:

- (1) Assess potential for injury related to bone marrow suppression:
 - (a) Expected nadir from prior cycle;
 - (b) Examine for symptoms of infection, bleeding, and anaemia.
- (2) Precaution for neutrophil count:
 - (a) Protect from microorganisms;
 - (b) Instruct on hygiene, oral care, daily bath, perineal hygiene;
 - (c) Inspect all intravenous sites;
 - (d) Avoid invasive procedures;
 - (e) Meticulous hand washing.
- (3) Platelets precautions if count less than 50 000/mm³:
 - (a) Protect patient from trauma, monitor for signs of bleeding;
 - (b) No intra-muscular or rectal medication, minimize venipunctures;
 - (c) Use sponge applicator, avoid flossing;
 - (d) Monitor platelets count.

II.1.2. Nursing diagnosis: potential for altered health maintenance

Expected outcomes: the patient will manage self-care as evidenced by verbal recall or return demonstration of instructions for self-assessment:

- Assessment of signs and symptoms of infection/ bleeding;
- Measures to avoid exposure to injury; when and how to notify.

Nursing intervention:

- (1) Assess baseline knowledge, learning style, level of anxiety;
- (2) Develop and implement teaching plan:
 - (a) Chemotherapy potential side effects;
 - (b) Self-care measures: assess signs and symptoms of infection, bleeding.
- (3) Measures to minimize exposure to infection and trauma;
- (4) Provide written information to reinforce teaching.

II.1.3. Nursing diagnosis: potential for activity intolerance related to fatigue/ malaise

Expected outcomes: the patient will maintain minimal activity.

Nursing intervention:

- (1) Assess for manifestation of fatigue: depression, anxiety, loss of independence, decreased level of concentration, difficulty making decisions;
- (2) Teach patient to increase rest periods and alternate rest and activity periods, prioritize activity, start exercise slowly, and increase gradually;
- (3) Teach patient to eat several small meals a day, select high energy foods.

II.2. Nursing care plan for patient experiencing nausea and vomiting

II.2.1. Nursing diagnosis: potential for altered nutrition, less than body requirement

Expected outcomes:

- (A) Patient will maintain weight within 5% of baseline;
- (B) Patient will be without nausea and vomiting or they will be minimal.

Nursing intervention:

- (1) Administer antiemetics as needed;
- (2) Suggest patient should avoid heavy, fatty, sweet, and spicy foods, encourage small frequent bland meals if tolerated, high-calorie, high-protein diet, increase fluid intake;
- (3) Encourage weekly weighing; refer to dietician if unable to stabilize weight.

II.2.2. Nursing diagnosis: potential for knowledge deficit regarding risk for stomatitis and self-care management

Expected outcomes:

- (C) The patient verbally repeats steps of self-assessment;
- (D) The patient demonstrates self-care techniques.

Nursing intervention:

- (1) Instruct patient on stomatitis as potential side effect of chemotherapy;
- (2) Instruct patient in daily oral examination using a mirror and flashlight (signs and symptoms to report: burning, redness, ulcers, dysphagia);
- (3) Instruct patient in self-care every 2 hrs if actual stomatitis occurs;
- (4) High-calorie, high-protein, cool, bland foods, small, frequent feedings, increase fluids to 3 litres of fluids/day.

II.3. Nursing care plan for patient experiencing stomatitis

II.3.1. Nursing diagnosis: potential for altered oral mucous membrane Grade 1 (generalized erythema), Grade 2 (small ulceration or white patches)

Expected outcomes: oral mucosa will be pink, moist, and intact within 5–7 days.

Nursing intervention:

- (1) Assess oral mucosa every shift; document size and location of lesion;
- (2) Assess comfort and ability to eat, drink;
- (3) Perform oral hygiene every 2 hrs during day and every 6 hrs during night:
 - (a) Warm normal saline rinses,
 - (b) If crusts, debris, thick mucous or saliva, then use sodium bicarbonate (1 teaspoonful in 200 ml water) every 4 hrs alternating with warm saline rinses every 4 hrs;
 - (c) Warm sterile normal saline rinses if white blood cell (WBC) count $<1000/\text{mm}^3$;
 - (d) For resistant debris or thick secretions or white patches; use hydrogen peroxide (1:4 strength) and rinse afterwards with water.
- (4) Encourage flossing and brushing with soft-bristled brush unless platelets $<40000/\text{mm}^3$ or WBC count $<1500/\text{mm}^3$;
- (5) Encourage patient to moisten lips with water-soluble lubricant;
- (6) Encourage patient to avoid citrus fruits and juices or spicy foods.

II.3.2. Nursing diagnosis: altered oral mucous membrane Grade 3

(Grade 3 = confluent ulcerations with white patches $>25\%$ or unable to drink liquids),
(Grade 4 = haemorrhagic ulcerations and/or unable to drink/eat solid food)

Expected outcomes: oral mucosa will heal within 10–14 days.

Nursing intervention:

- (1) Assess oral mucosa every 4hrs for evidence of infection and response to therapy;
- (2) Assess ability to eat, drink, communicate, level of comfort;
- (3) Cleanse mouth every 2hrs while awake, every 4hrs during the night:
 - (a) Alternate warm saline mouth rinse with antifungal or antibacterial oral suspension every 2 hrs;
 - (b) Use sodium bicarbonate solution for thick secretions, or use 1:4 hydrogen peroxide followed by water or saline rinse;

- (4) Use mild analgesic every 2 hrs, timing 15 minutes before meal; gargles as ordered must be swished 2 min (10–15cc swish/spit every 3hrs, duration 20 min).

II.3.3. Nursing diagnosis: potential for fluid volume deficit

Expected outcomes: the patient's skin will be normal, mucous membrane will be moist.

Nursing intervention:

- (1) Encourage 3 litres of fluids/day;
- (2) Monitor intake/output.

II.4. Nursing care plan for patient experiencing diarrhoea

II.4.1. Nursing diagnosis: A. Potential for altered nutrition: less than body requirements; B. Potential for perineal impaired skin integrity related to diarrhoea

Expected outcomes:

- Patient will maintain baseline weight within 5%;
- Skin and perineal mucosa will remain intact.

Nursing intervention:

- (1) Assess patient's weight, dietary preferences, pattern of bowel elimination;
- (2) Assess perineal skin for integrity and for signs and symptoms of irritation;
- (3) Monitor intake/output, daily weight, calorie count as appropriate;
- (4) Encourage high-calorie, high-protein, low-residue diet in small, frequent meals (cottage cheese, yogurt, broth, fish, custard, cooked cereals, cooked vegetables, peeled apples, macaroni), liquid diet if diarrhoea is severe;
- (5) Discourage food that stimulate peristalsis (wholegrain bread, fried food, fruit juices, raw vegetables, nuts, rich pastry, caffeine-containing drinks);
- (6) Encourage foods high in potassium as appropriate (bananas, baked potatoes), monitor serum potassium and other electrolytes;
- (7) Administer antidiarrhoeal medication as ordered;
- (8) Recommend sitz baths after each stool, if diarrhoea is severe;
- (9) Instruct in skin cleansing with water and mild soap after each stool and application of skin barrier and topical anaesthetic as needed.

II.5. Nursing care plan for patient experiencing neuropathy

II.5.1. Nursing diagnosis: Potential for injury related to decreased sensitivity to temperature, gait disturbance

Expected outcomes: The patient will develop safe measures to compensate for losses.

Nursing intervention:

- (1) Assess sensory perception to light touch, pinprick, temperature, vision;
- (2) Assess ability to tolerate light touch, cool water, presence of numbness and tingling, presence of painful sensation, ability to write;
- (3) Discuss alteration in sensation and impact on the ability to perform daily activities;
- (4) Instruct patient in safety measures: using gloves when cooking or washing dishes;
- (5) Inspect skin daily for cuts, abrasions and burns, especially arms, fingers, and toes.

II.5.2. Nursing diagnosis: potential for knowledge deficit of self-care measures

Expected outcomes:

- The patient will verbally repeat self-care measures and schedule for carrying them out;
- The patient will have control over self-care activities.

Nursing intervention:

- (1) Instruct patient in self-care measures, increase fluid intake, eat small frequent high-protein, high-calorie bland meals;
- (2) Encourage patient to live as normal a life style as possible;
- (3) Involve patient in treatment decisions.

II.5.3. Nursing diagnosis: potential for non-compliance with self-care activities

Expected outcomes: the patient will comply with prescribed measures 90% of time.

Nursing intervention: reinforce teaching prior to treatment.

II.6. Nursing care plan for the patient experiencing psychosocial distress

II.6.1. Nursing diagnosis: anxiety

Expected outcomes:

- The patient will discuss feelings;
- The patient will respond to relaxation technique with decreased anxiety;
- Manage the anxiety response to stress effectively.

Nursing intervention:

- (1) Assess signs and symptoms of anxiety such as:
 - (a) decreased attention span, perceptual deficit
 - (b) restlessness, irritability
 - (c) feeling of discomfort, hyperactivity, wringing of hands
 - (d) decreased ability to communicate verbally;
- (2) Remain calm in your approach to the patient;
- (3) Use short, simple, and clear statements;
- (4) Avoid asking or forcing the patient to make choices;
- (5) Encourage the patient to participate in relaxation exercises such as:
 - (a) breathing exercises, meditation, imagination
 - (b) progressive muscle relaxation;
- (6) Teach the patient to use relaxation techniques independently.

II.6.2. Nursing diagnosis: ineffective coping

Expected outcomes:

- The patient will verbalize feelings;
- Identify his/her behavioural response to stress;
- Demonstrate alternative way to deal with stress;
- Participate in realistic discussion of problems and discuss future plans.

Nursing intervention:

- (1) Assess signs and symptoms of ineffective coping such as:
 - (a) overdependence on others;
 - (b) avoidance pattern of behaviour, lack of confidence;
 - (c) ineffective expression of feelings;
- (2) Help the patient recognize early signs of anxiety;
- (3) Encourage patient to explore feelings and possible sources of anxiety;
- (4) Teach the patient a step-by-step approach to solving problems;
- (5) Support the patient to review his/her abilities realistically;
- (6) Give the patient positive feedback when solving problems, learning to relax, and expressing feelings.

II.6.3. Nursing diagnosis: disturbed body image

Expected outcomes:

- The patient will verbalize physical change;
- Discussed disturbed body image with staff members and relatives;
- Express feelings, verbally and nonverbally;
- Maintain an adequate balance of rest, sleep, nutrition and activity;
- Participate in social activities or groups.

Nursing intervention:

- (1) Assess actual or perceived physical change, verbal and nonverbal response to change in body structure or function;
- (2) Encourage discussion of the physical change in simple terms;
- (3) Encourage expression of feelings;
- (4) Help patient to identify strengths and abilities that are not affected by the physical change;
- (5) Teach the patient about the physical change and needed self-care skills;
- (6) Discuss with the patient ways of adapting life style and activities;
- (7) Help the patient prepare to achieve and sustain his/her optimal level of functioning in the future;
- (8) Give the patient positive feedback when solving problems.

APPENDIX III NUTRITIONAL ADVICE

Dietary advice and self-care measures to alleviate specific symptoms associated with altered nutritional intake.

III.1. Anorexia

- Provide small, frequent, high-calorie meals and snacks throughout the day
- Use high-energy food to enhance calorie intake e.g. cream, cheese, eggs, full-fat milk
- Use gentle exercise, relaxation to stimulate appetite, encourage family meals where possible
- If nausea or smell is a problem, cold food is better tolerated
- Encourage attractive presentation of foods

III.2. Mucositis, stomatitis xerostomia, dysphagia, oesophagitis, gastritis

- Encourage regular mouth wash before and after food, avoid commercial mouthwash
- Ensure that adequate pre-meal analgesia is given
- Use soft or liquid foods such as soup, mashed potatoes, fruit and cooked vegetables, milk, puddings, custard
- Avoid dry, spicy, salty, acidic foods, add extra sauces, creams to solid foods
- Encourage the use of straws to avoid excessive irritation
- Discourage smoking, drinking alcohol

III.3. Taste change

- Use plastic cutlery if patient has a metallic taste, use herbs, flavourings, marinades, sauces
- Try white meat and dairy products
- Give sugar-free mints, give a lemon wedge to suck before eating
- Give lemonade, tea with lemon, citrus fruits

III.4. Nausea and vomiting

- Give prescribed antiemetics half an hour before meals, provide small frequent meals
- Dry, bland foods may be easier to take, use fizzy drinks and provide a straw, encourage drinks to be sipped slowly

III.5. Diarrhoea

- Replace fluids, encourage low-fat diet
- Reduce fever if low-fat diet is ineffective
- Consider antidiarrhoeal medication

APPENDIX IV PATIENT EDUCATION TOOLS

Goals of radiotherapy teaching include:

- Helping the patient to adjust to treatment;
- Explaining how the treatment will affect the cancer;
- Imparting the sequence of administration;
- Recognizing and controlling side effects;
- Encouraging self-care behaviors that minimize side effects;
- Listing side effects that should be reported to the responsible physician.

IV.1. Skin reaction

IV.1.1. Erythema

- Gentle washing, using mild unperfumed soap or shampoo and warm water
- Avoid friction, pat the skin dry with soft towel
- Keep treated area dry and free from irritation
- Use of simple moisturizer e.g. aqueous cream, do not apply any skin lotions for 2 hours following treatment
- Avoid perfumed products, deodorants, make-up
- Use an electric razor instead of wet shaving
- Protect skin from sun and high temperature, wear a hat with a broad brim and shirt with long sleeves
- Use 1% hydrocortisone for itching areas
- Avoid using heating pads or ice packs on the skin in the treated area
- Wear loose cotton clothing, avoid clothes that may cause friction by rubbing over the treated skin
- Do not use adhesive tape on the treated area
- Do not swim in salt water, lakes, or pools
- Always report any discomforts or concerns to your nurse or doctor

IV.1.2. Moist desquamation

- Use dressing such as hydrocolloids, hydrogels, and alginates, to provide moist healing
- Dressing must be able to absorb varying amount of serous leakage associated with dermal damage, and must be removed without disturbing granulation

IV.1.3. Lymphoedema

Preventive and self-care approach:

- Keep the skin as clean as possible, use warm water to wash, dry properly;
- Moisturize the skin every day to prevent dryness;
- Treat cuts quickly, see a doctor straight away if there are any signs of infection such as redness or inflammation;

- Wear gloves when doing housework, thimble when sewing;
- Keep nails short, using clippers not scissors;
- Avoid constricting clothing, and jewellery around affected arm;
- Use insect repellent when outside in hot areas;
- Avoid injections, blood pressure reading, and having blood taken from an affected limb;
- Avoid excessive heat, i.e. hot weather, hot baths, hot showers;
- Massage technique to improve lymph drainage;
- Exercise while wearing bandages to promote lymph circulation.

IV.1.4. Mucositis: A sore mouth

- Examine your mouth at least once daily.
 - Use a flashlight and mirror to look in your mouth.
 - Look for any ulcers, red areas, or patches.
- Keep your mouth clean and moist.
 - Clean your teeth even though your mouth is sore. Use a soft brush, use stick with a soft sponge tip.
 - Hold the stick at a 90-degree angle to the gum line so the sponge can reach in between the teeth.
 - Gently massage gums, tongue, top of the mouth.
 - Keep your dentures in only during meals.
 - Rinse your mouth with salt solution or a 1.5% hydrogen peroxide solution every 1-2 hours for 1 to 2 minutes, followed by rinsing with water.
 - Keep lips and inside of your mouth moisturized.
 - If your mouth is very dry, drink water and other fluids frequently throughout the day. Chew sugarless gum or suck hard candy to moisten your mouth.
- Before meals and as needed for comfort, apply an anesthetic, such as benzocaine or Xylocaine, to sore areas of your mouth, using cotton-tipped applicator, swished around the entire mouth.
- Take a pain medicine 1.5 to 2 hours before meals.
- If bleeding occurs, apply pressure to the site of bleeding using a piece of clean gauze dipped in ice water or a wet tea bag that has been partially frozen (the tannin in the tea will help stop the bleeding). Rinsing your mouth with ice water may be helpful.
- If an infection develops in your mouth, follow doctor's instructions.
- Eat well-balanced diet. Include high-protein food.
 - Take vitamin and mineral supplement daily.
 - Eat frequently and in small amounts. Avoid rough or spicy food.
 - Drink 3 litres of fluid a day unless restricted.
- Report the following to your doctor or nurse:
 - Redness or extreme dryness, soreness or pain;
 - Cracks, ulcers, blisters, white patches;
 - Bleeding from your mouth;
 - Difficulty swallowing;

IV.1.5. Diarrhoea

- As soon as diarrhoea starts, take clear liquid diet
- Avoid eating foods high in fiber, fatty foods, rich desserts, and foods that increase bowel activity such as hot peppers, raw vegetables, beans, cabbage, spicy food, dairy products, and drinks with caffeine
- Eat small, frequent meals. Increase fluids intake
- Eat foods that are high in potassium, such as bananas, potatoes, and apricots, because diarrhoea causes potassium loss
- Use an antidiarrhoeal medicine for loose stools
- Let your doctor or nurse know if these measures do not control your diarrhoea. In addition, you should call them immediately if:
 - You have a temperature of 38C° or greater;
 - You have bloody stools, severe abdominal pain;
 - You are unable to keep liquids for more than 12 hrs;
 - You become suddenly dizzy, or feel disoriented.

IV.2. Fatigue

- Perform light exercises and aerobics each day
- Prioritize and schedule activities, but try to stay active
- Limit your activities, if possible, balancing activities and rest
- Increase rest by getting more sleep at night, taking naps during day
- Stress management technique and relaxation
- Prepare meals ahead of time and freeze them, eat even when you are tired to increase energy, drink plenty of fluids each day
- Accept help from friends and relatives

IV.3. Non-pharmacological management for urinary symptoms

IV.3.1. Bladder-retraining technique

- Delay bladder emptying for as long as possible whenever they experiences the need to pass urine
- Pass urine by the clock, pick an interval you can meet (1-2 hrs)
- Practise distraction, relaxation to alleviate anxiety and depression
- As each interval becomes more manageable, increase it

IV.3.2. Pelvic floor exercises

These exercises involve tightening and contracting pelvic floor muscles. Use them with biofeedback techniques.

APPENDIX V

GUIDELINES FOR WRITING A CASE STUDY ON A PATIENT RECEIVING RADIOTHERAPY

V.1. Purpose

The aim is to help the nurse understand what the patient and his/her family experience during the course of radiotherapy. The work should be written after accompanying an individual patient through the whole course of radiation treatment.

V.2. Introduction

Provide a short introduction to the patient and his/her diagnosis. Indicate how the nurse sees the task of accompanying the patient through his/her course of treatment, the aim of the project and expected outcome.

V.3. Method

Briefly describe the demographic background of the patient and his family. Describe how the patient sees himself and his life before the diagnosis. Describe how the patient sees his illness, how he understands his illness and the changes it has had on his life, his outlook on life, feelings of loneliness, self-control, self worth, behaviour, strengths and weaknesses, social and family life.

How does the patient and his family describe his contact with and the treatment provided by the health care professionals: radiation oncologist, technologists and nurses? What are his expectations from them and do they answer his needs?

Describe the experience of a close family member, his relationship with the patient, satisfactions and difficulties of accompanying the patient, how the course of the radiation treatment affects his daily routine.

V.4. Course of the interaction

Follow the patient through the course of the radiation treatment, meeting with him/her at the following times during and after the treatment:

- After his first meeting with the radiation oncologist:
 - To hear what he understood from the doctor's explanation;
 - To provide the patient with additional information;
 - To assess the level of anxiety and to help to reduce it if necessary.
- After the simulation:
 - To explain the purpose and necessity for the simulation procedure;
 - To hear from the patient the experience of the simulation, interaction with the staff, experience of being exposed.
- On the first day of treatment:
 - To explain the side effects that are likely to occur and to describe ways of dealing with them;
 - To explain the course of the treatment, what to expect as time goes on, when and how to make contact with the nurse or doctor.

- Once a week during the course of treatment:
 - To record the physical and emotional state of the patient;
 - To discuss with the patient any changes that have occurred during the week and any necessary nursing interventions.
- On the last day of the treatment:
 - To explain what the patient is likely to experience following the conclusion of the treatment and how long the side effects are likely to continue;
 - When and where the patient is to continue his oncology follow up care;
 - To assess the psychological effect of the radiation treatment on the patient and how he has coped with the disturbances in his daily routine caused by the daily treatment;
 - To assess how well the family is coping and how this has affected his interaction with his family.
- One month after completion of treatment:
 - To meet the patient in his home surroundings, if possible, or somewhere else other than in the oncology department;
 - To see how he has returned to his normal way of life, how he has coped with the side effects of the treatment and whether they have resolved.

At each meeting, emphasis should be put not only on the physical aspects of the treatment, but also on the emotional side of how the patient and his family are adapting to the changes.

V.5. Discussion

Discuss the significance of the process of accompanying the patient during the course of radiotherapy. What effect has it had on you, the nurse? Has it changed or enhanced your understanding of the process? What benefit has this had on the patient and his family?

Are all the health care professionals doing their utmost to provide optimal care for the patient during his treatment? How could the process be changed in order to make it easier for the patient and his family?

The written report should be about 5–6 printed pages, not including references.

APPENDIX VI
STUDENT EVALUATION SHEET

VI.1. Competency-based practice

Upon completion of the training course, the student should demonstrate competency in the following tasks (score on a scale of 1–10):

	Maximum points	Points awarded for this task
Assessment of skin/wound care	10	
Assessment and management of oral cavity	10	
Assessment and management of fatigue	10	
Assessment and management of nutritional status	10	
Assessment of the patient receiving brachytherapy or unsealed radionuclides	10	
Counselling in EBRT	10	
Counselling in BT	10	
Stoma care	10	
Counselling of children and family	10	
Care of BT patient being treated with sealed or unsealed sources	10	
Assistance in gynaecological and other BT procedures	10	
Paediatric catheters care	10	
Handling of RT emergencies	10	
Lymphoedema care	10	
Care of a laryngotomy patient	10	

End-of-life care	10	
Application of radiation protection principles	10	
TOTAL MARKS	170	

VI.2. Patient case study

	Points awarded
Patient case study	

VI.3. Multiple choice questionnaire (MCQ) examination

	Points awarded
MCQ examination	

VI.4. Evaluation of professional development

	Comments
Professional appearance (Uniform/overall neatness)	
Reliability (Attendance/punctuality/accurate reporting/carrying out tasks)	
Initiative (Ability/willingness to take action; asking questions/seeking help)	
Professional manner (Courtesy/participation in discussions; empathy/common sense)	
Independence and teamwork	
Safety (Includes radiation awareness/prevention of cross-infection/patient's safety)	

Clinical Supervisor's comments:

Student's comments:

Clinical Supervisor's signature

Student's signature

Date

APPENDIX VII COMMON TERMINOLOGY CRITERIA FOR ADVERSE EVENTS (CTCAE)

What is an *Adverse Event*?

Multiple clinical terms are used to convey ‘Adverse Event’ including side effect, acute or late effect, complication, toxicity, morbidity, etc. — all essentially pointing to a change possibly caused by treatment. The National Cancer Institute (NCI) defines an Adverse Event as:

Any unfavourable symptom, sign, or disease (including an abnormal laboratory finding) associated with the use of a medical treatment or procedure that may or may not be considered related to or caused by the medical treatment or procedure.

Multiple systems have been developed for grading the adverse events of cancer treatment. The National Cancer Institute Common Toxicity Criteria (CTC) system has substantially evolved since its inception in 1983. The most recent version, CTCAE v3.0 (Common Terminology Criteria for Adverse Events version 3.0, available at <http://ctep.cancer.gov/forms/CTCAEv3.pdf#search=%22NCI%20common%20terminology%20criteria%22>), represents the first comprehensive, multimodality grading system for reporting the acute and late effects of cancer treatment. The new CTC system requires changes in the application of adverse event criteria including new guidelines regarding late effects, surgical and paediatric effects, multimodality issues, and for reporting the duration of an effect. It builds on the strengths of previous systems, represents a considerable effort among hundreds of participants, and signifies an international collaboration and consensus of the oncology research community. This system is recommended here for its use as a practical tool for the classification of adverse events in the implementation of research in radiation oncology nursing.

The CTCAE v3.0 system provides definitions for adverse event terms and a five-grade severity scale for each adverse event. Many new site/organ-specific criteria relevant to loco-regional therapy trials and late events are incorporated into one document without distinguishing between acute, late, chronic, or permanent adverse events.

Adverse events can be symptomatic or completely asymptomatic, clinically or radiographically detected or noted on laboratory studies or other testing. The intent is to capture any effect associated with treatment which may be deleterious.

The CTCAE v3.0 does not render judgement with respect to causality or blame or error. The CTCAE v3.0 is designed as a clinical trials research tool, and is not developed to be used to comparatively evaluate adverse events in routine clinical practice or as a way of monitoring adherence to standards of care.

The purpose of the CTCAE v3.0 is to facilitate the evaluation of new cancer therapies, treatment modalities, and supportive measures and to standardize reporting of adverse events across groups and modalities.

It is important to remember that for the purposes of the CTCAE v3.0, an adverse event is not necessarily caused by a therapeutic intervention. The process of attribution for an adverse event generally comes after the naming and grading of that Adverse Event.

APPENDIX VIII
RTOG/EORTC LATE MORBIDITY SCORING SCHEME

Table 1. RTOG/EORTC Late Morbidity Scoring Scheme
Use for toxicity occurring later than 90 days after radiotherapy

GRADE					
Toxicity	0	1	2	3	4
Bladder-Late RT Morbidity Scoring	No change from baseline	Slight epithelial atrophy/minor telangiectasia (microscopic haematuria)	Moderate frequency/generalized telangiectasia/intermittent macroscopic haematuria	Severe frequency and dysuria/severe generalized telangiectasia (often with petechiae); frequent haematuria; reduction in bladder capacity (< 150 cc)	Necrosis/contracted bladder (capacity < 100 cc)/severe haemorrhagic cystitis
Bone-Late RT Morbidity Scoring	No change from baseline	Asymptomatic; no growth retardation; reduced bone density	Moderate pain or tenderness; growth retardation; irregular bone sclerosis	Severe pain or tenderness; complete arrest of bone growth; dense bone sclerosis	Necrosis/spontaneous fracture
Brain-Late RT Morbidity Scoring	No change from baseline	Mild headache; slight lethargy	Moderate headache; great lethargy	Severe headaches; severe CNS dysfunction (partial loss of power or dyskinesia)	Seizures or paralysis; coma
Oesophagus-Late RT Morbidity Scoring	No change from baseline	Mild fibrosis; slight difficulty in swallowing solids; no pain on swallowing	Unable to take solid food normally; swallowing semi-solid food; dilatation may be indicated	Severe fibrosis; able to swallow only liquids; may have pain on swallowing; dilation required	Necrosis/perforation; fistula
Heart-Late RT Morbidity Scoring	No change from baseline	Asymptomatic or mild symptoms; transient T wave inversion and ST changes; sinus tachycardia > 110 (at rest)	Moderate angina on effort; mild pericarditis; normal heart size; persistent abnormal T wave and ST changes; low QRS	Severe angina; pericardial effusion; constrictive pericarditis; moderate heart failure; cardiac enlargement; EKG abnormalities	Tamponade/severe heart failure/severe constrictive pericarditis
Joint-Late RT Morbidity Scoring	No change from baseline	Mild joint stiffness; slight limitation of movement	Moderate stiffness; intermittent or moderate joint pain; moderate limitation of movement	Severe joint stiffness; pain with severe limitation of movement	Necrosis/complete fixation
Kidney-Late RT Morbidity Scoring	No change from baseline	Transient albuminuria; no hypertension; mild impairment of renal function; urea 25 - 35 mg%; creatinine 1.5 - 2.0 mg%; creatinine clearance > 75%	Persistent moderate albuminuria (2+); mild hypertension; no related anaemia; moderate impairment of renal function; urea > 36 - 60 mg%; creatinine clearance > 50 - 74%	Severe albuminuria; severe hypertension; persistent anaemia (< 10 g%); severe renal failure; urea > 60 mg%; creatinine > 4 mg%; creatinine clearance < 50%	Malignant hypertension; uremic coma/urea > 100%
Larynx-Late RT Morbidity Scoring	No change from baseline	Hoarseness; slight arytenoid oedema	Moderate arytenoid oedema; chondritis	Severe oedema; severe chondritis	Necrosis

Toxicity	GRADE				
	0	1	2	3	4
Liver- Late RT Morbidity Scoring	No change from baseline	Mild lassitude; nausea; dyspepsia; slightly abnormal liver function	Moderate symptoms; some abnormal liver function tests; serum albumin normal	Disabling hepatic insufficiency; liver function tests grossly abnormal; low albumin; oedema or ascites	Necrosis/hepatic coma or encephalopathy
Lung- Late RT Morbidity Scoring	No change from baseline	Asymptomatic or mild symptoms (dry cough); slight radiographic appearances	Moderate symptomatic fibrosis or pneumonitis (severe cough); low grade fever; patchy radiographic appearances	Severe symptomatic fibrosis or pneumonitis; dense radiographic changes	Severe respiratory insufficiency/ continuous O ₂ /assisted ventilation
Mucous membrane- Late RT Morbidity Scoring	No change from baseline	Slight atrophy and dryness	Moderate atrophy and telangiectasia; little mucus	Marked atrophy with complete dryness; severe telangiectasia	Ulceration
Salivary glands- Late RT Morbidity Scoring	No change from baseline	Slight dryness of mouth; good response on stimulation	Moderate dryness of mouth; poor response on stimulation	Complete dryness of mouth; no response on stimulation	Fibrosis
Skin- Late RT Morbidity Scoring	No change from baseline	Slight atrophy; pigmentation change; some hair loss	Patchy atrophy; moderate telangiectasia; total hair loss	Marked atrophy; gross telangiectasia	Ulceration
Small/Large intestine- Late RT Morbidity Scoring	No change from baseline	Mild diarrhoea; mild cramping; bowel movement 5 x daily slight rectal discharge or bleeding	Moderate diarrhoea and colic; bowel movement > 5 x daily; excessive rectal mucus or intermittent bleeding	Obstruction or bleeding, requiring surgery	Necrosis/ perforation fistula
Spinal cord- Late RT Morbidity Scoring	No change from baseline	Mild Lhermitte's syndrome	Severe Lhermitte's syndrome	Objective neurological findings at or below cord level treatment	Mono-, para-, quadriplegia
Subcutaneous tissue- Late RT Morbidity Scoring	No change from baseline	Slight induration (fibrosis) and loss of subcutaneous fat	Moderate fibrosis but asymptomatic; slight field contracture; < 10% linear reduction	Severe induration and loss of subcutaneous tissue; field contracture > 10% linear measurement	Necrosis
Eye- Late RT Morbidity Scoring	No change from baseline	Asymptomatic cataract; minor corneal ulceration or keratitis	Symptomatic cataract; moderate corneal ulceration; minor retinopathy or glaucoma	Severe keratitis; severe retinopathy or detachment; severe glaucoma	Panophthalmitis; blindness

**APPENDIX IX
PHYSICAL PROPERTIES OF CURRENTLY USED
SEALED RADIOACTIVE SOURCES**

ISOTOPE	HALF-LIFE	BETTA ENERGY	AVERAGE GAMMA ENERGY	SOURCES AND USES
Co-60	5.26 years	0.3 MeV	1.25 MeV	Cylinders for teletherapy machines, microsources for HDR brachytherapy
Cs-137	30 years	0.5 and 1.17 MeV	0.662 MeV	Small tubes for gynaecological brachytherapy
Ir-192	74 days	0.24-0.67 MeV	0.38 MeV	Wires and seed-ribbons for interstitial LDR brachytherapy Single high specific activity sources for HDR brachytherapy.
I-125	59.4 days	none	0.028 MeV	Small seeds for prostate brachytherapy
Pd-103	17 days	none	0.021 MeV	Small seeds for prostate brachytherapy
Sr-90-Yr-90	29 days	0.54, 2.72	none	Small seeds for intravascular brachytherapy

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<http://www.iaea.org/>

International Union against Cancer (UICC)

<http://www.uicc.org/>

NCI Common Terminology Criteria for acute toxicity

<http://ctep.cancer.gov/forms/CTCAEv3.pdf#search=%22NCI%20common%20terminology%20criteria%22>

ABBREVIATIONS

ALARA	as low as reasonably achievable
BMS	Bone marrow suppression
CNS	Central nervous system
CT	Computed tomography
CTC	Common toxicity criteria
3D-CRT	Three-dimensional conformal radiotherapy
DNR	Do not resuscitate
EBRT	External beam radiotherapy
EKG	Electrocardiogram
GI	Gastrointestinal
GYN	Gynaecologic
HDR	High dose rate
IAEA	International Atomic Energy Agency
IMRT	Intensity modulated radiotherapy
IGRT	Image guided radiotherapy
IORT	Intraoperative radiotherapy
LDR	Low dose rate
OR	Operating room
QA	Quality assurance
QOL	Quality of life
RSO	Radiation Safety Officer
RT	Radiotherapy
TBI	Total body irradiation



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