Hong Kong College of Radiologists
Training Requirement for Vascular Brachytherapy

Introduction

Brachytherapy, the use of radioactive isotopes in the treatment of disease at close distance, has a long history in clinical medicine. Ever since Madame Curie discovered Radium, a variety of isotopes were used in the treatment of benign and malignant diseases with different techniques. The sources could be delivered in the form of seeds or wires, pre-loaded or after-loaded, to target a high dose delivery around the treatment area and at the same time limit the dose to the surround healthy tissue by taking advantage of the rapid fall off of radiation dose at short distance. In modern clinical practice, brachytherapy using sealed sources are almost always planned, monitored and delivered by trained clinical oncologists.

Soon after the use of radiation a century ago, it was recognised that radiation can produce serious long-term side effects and later when safer alternatives were available, radiation treatment was mostly restricted to the treatment of malignant diseases. The use of radiation in the treatment of benign diseases is currently restricted to very special cases, e.g. I131 treatment of thyrotoxicosis, external radiotherapy for keloids, or brachytherapy for pterygium.

Vascular Brachytherapy

Percutaneous Transarterial Catheter-based Angioplasty has been established as one of standard interventional treatment for coronary artery diseases. However one of the problems is re-stenosis of the artery after angioplasty and stenting. It has been shown that by the delivery of brachytherapy to the area that suffered “barotraumas” during the procedure can effectively reduce the incident of re-stenosis. The treatment was introduced in the Hospital Authority (HA) of Hong Kong and private hospitals about a year ago. Within HA, the service is provided by the five Clinical Oncology Centres.

The Technology

A. To use sealed radioactive sources in close proximity to the target lesion in order to achieve high local radiation dose with rapid fall off and thus minimising the exposure to the surrounding healthy tissue. The rationale is to irradiate the vessel to prevent intimal hyperplasia and other reactions to barotrauma to prevent re-stenosis.
B. Beta or gamma sources are usually deployed and are normally introduced through special catheters to the target lesions. The sources are designed to deliver the treatment to the accuracy of within millimetres and that the dose fall off is also well calibrated to deliver a high dose in short interval and at the same time have minimal dose to the rest of the heart.
C. The treatment is inherently risky because of the high dose and high dose rate and also that the dosimetry is critically dependent on the accuracy of

the calibration, placement and also treatment delivery. It is also well known that low dose radiotherapy would in fact exacerbate the hyperplasia and causing more harm than good.

D. This is a new treatment using radiotherapy for a benign disease and it is still uncertain as to the long-term side effects. It is for this reason that meticulous attention of dosimetry, documentation of the procedure, outcome and complication is highly recommended.

Role of the Operator

A. Oversees the whole radiation treatment
B. Consult with patient regarding radiation risks and benefit of proposed therapy
C. Assess patient risk including prior radiation therapy to chest or target area
D. Review proposed treatment plan with cardiologist
E. Ensure proper placement of treatment catheter
F. Ensure proper delivery of treatment – dose, dose rate, prescription point, calibration and patient condition during treatment
G. Confirm proper completion of treatment and withdrawal of source, documentation of procedure
H. Follow up of patient for acute and delayed reaction to the treatment
I. Quality assurance of the system (clinical audit), licensing and related statutory requirement compliance

Necessary training

In US, the procedure is normally performed by radiation oncologists because they have the necessary training and experience including

A. Examining the patients and reviewing the case histories to determine their suitability for brachytherapy treatment and their limitations and contraindications
B. Selecting the proper brachytherapy sources and dose and method of administration
C. Calculating the dose
D. Post-administration follow-up and review of case histories
E. Radiation physics and instrumentation
F. Radiation protection
G. Mathematics pertaining to the use and measurement of radioactivity
H. Radiation biology
I. Handling of radioisotopes including sealed sources
J. Preparing, implanting and removing of sealed sources
K. Oversees the medical physicists and radiographers in the administrative control of sealed sources
L. Oversees the administrative controls to prevent misadministration of the sources and its by-products

The Consensus Process

The College received verbal and written enquiries whether there is a need for prescribed training requirements for Vascular Brachytherapy. The College President, advised by the College Council, instructed Dr CC Yau of Queen Mary Hospital to convene a group to discuss on the issue and to report to the Council for further deliberation and endorsement.

Initial review of the situation indicated that about a hundred treatments were already piloted by Clinical Oncologists in HA specialising in brachytherapy. Clinical Oncologists from Queen Elizabeth Hospital, Pamela Youde Nethersole Eastern Hospital and Queen Mary Hospital were invited to input on the necessary training requirement.

Information search on published and Internet materials were conducted for established guidelines and recommendations, to be used as a starting point for discussion. It was found that the most comprehensive and specific guidelines on the use of brachytherapy was published by the US Nuclear Regulatory Commission[1],

The following was recommended, discussed and endorsed by the Council of the Hong Kong College of Radiologists on 26th February 2002.

Recommendation on Training Requirement for Vascular brachytherapy Operators:

The procedure should be supervised and delivered by a physician who is either:

A. An authorised user which can be a Specialist in Clinical Oncology, Fellow of the Hong Kong College of Radiologists (Clinical Oncology), Fellow of the Royal College of Radiologists (Clinical Oncology), or one having equivalent professional qualifications in Clinical Oncology or Radiation Oncology.

or

B. In the active practice of therapeutic radiology, has had classroom and laboratory training in radioisotope handling techniques applicable to the therapeutic use of brachytherapy sources, supervised work experience, and supervised clinical experience as follows:

(1) 200 hours of classroom and laboratory training that includes:

(i) Radiation physics and instrumentation;

(ii) Radiation protection;

(iii) Mathematics pertaining to the use and measurement of radioactivity; and

(iv) Radiation biology;

(2) 500 hours of supervised work experience under the supervision of an authorized user at a radiotherapy centre that includes:

(i) Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;

(ii) Checking survey meters for proper operation;

(iii) Preparing, implanting, and removing sealed sources;

(iv) Maintaining running inventories of material on hand;

(v) Using administrative controls to prevent the misadministration of byproduct material; and

(vi) Using emergency procedures to control byproduct material; and

(3) Three years of supervised clinical experience that includes one year in a formal training program approved by the Hong Kong College of Radiologists on Clinical Oncology, and an additional two years of clinical experience in therapeutic radiology under

the supervision of an authorized user at a radiotherapy centre that includes:

(i) Examining individuals and reviewing their case histories to determine their suitability for brachytherapy treatment, and any limitations or contraindications;

(ii) Selecting the proper brachytherapy sources and dose and method of administration;

(iii) Calculating the dose; and

(iv) Post-administration follow up and review of case histories in collaboration with the authorized user.

[1] US Nuclear Regulatory Commission, The Code of Federal Regulations: Title 10 – Energy, PART 35 -- MEDICAL USE OF BYPRODUCT MATERIAL, section 35.940 Training for use of brachytherapy sources